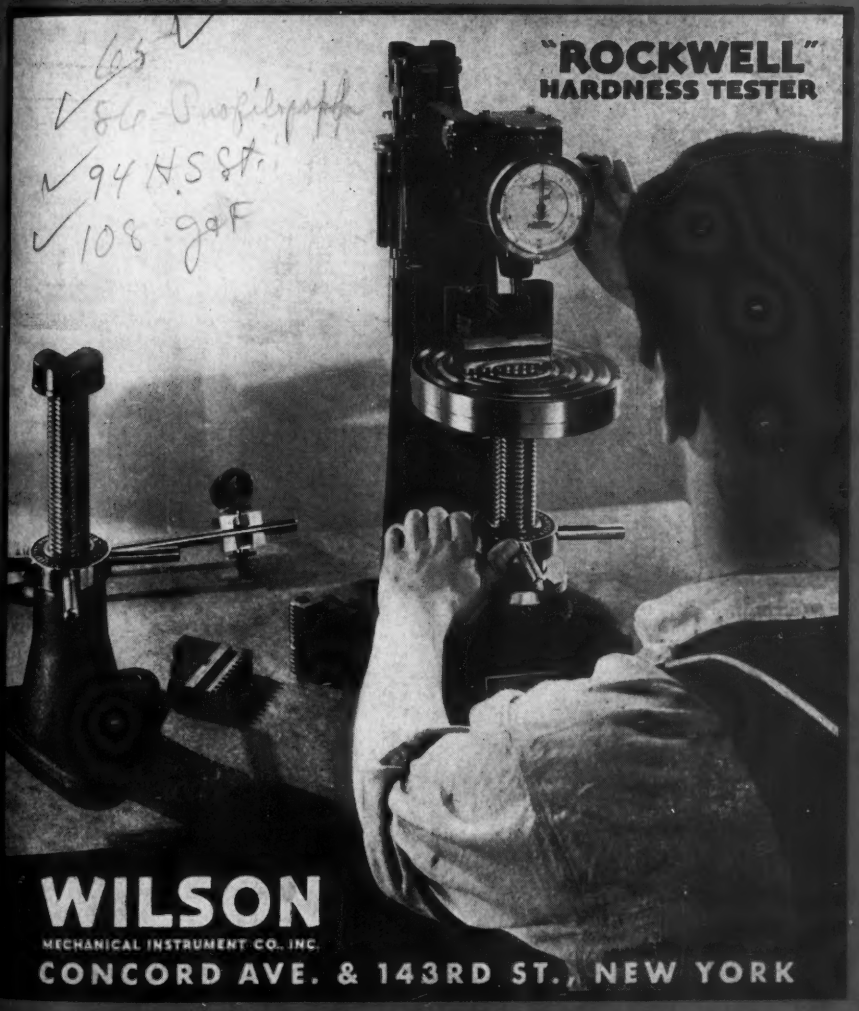
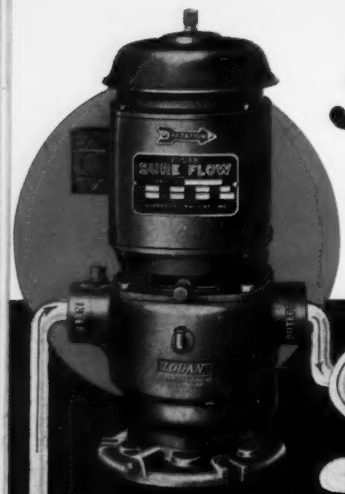
MODERN Machine Shop

September, 1937





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HOWARD CAMPBELL, Editor

Volume 10 SEPTEMBER, 1937 Number 4

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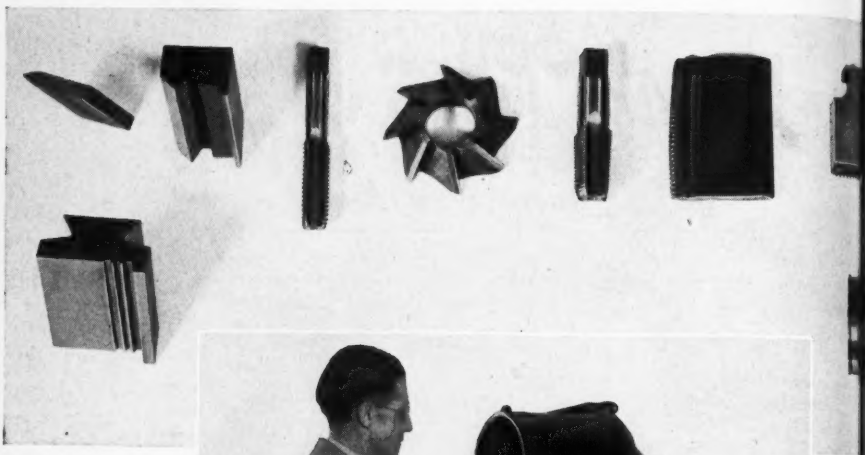

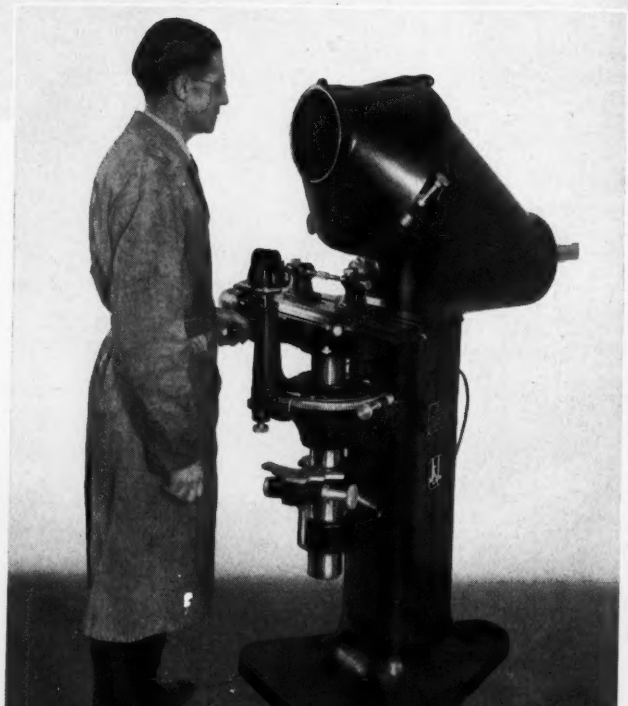

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MODERN Machine Shop

CINCINNATI, OHIO

SEPTEMBER, 1937 VOL. 10, No. 4

Maintaining Production by "Banking" Stock

From the "lot" system to continuous production and thence to reserve banks has been the record of progress in material handling in the automobile industry

BY E. W. SOESBE

Plant Layout Engineer, Chrysler Corporation

FOR more than twenty years the production of parts in the larger automobile factories has been based on the system of material handling known as "continuous production," which consists principally in having the machines and equipment so placed that, upon completion of an operation on a work-piece, the piece is immediately passed on to the next workman for the next operation. This system is practically ideal, but it presupposes that all equipment not only is, but will continue to remain, in ideal condition.

Every effort has been made, through these years, to achieve this ideal condition. Extra sets of tools have been maintained at the machines to replace any which might fail. Extra parts for the machine tools have been kept on hand, and one large plant was said to have maintained a complete duplicate set of machines so that in case of machine failure the broken-down machine could be replaced at once with a good one.

With all these precautions, however, it has been impossible to prevent delays, and in the modern automobile plant even a few minutes delay on one operation may mean just that much delay on all subsequent operations, with scores—if not hundreds—of men idle and waiting for production to resume. With not only production lines, but departments and even whole plants geared together on a definite production schedule, this delay may cause more confusion and loss than such a small matter would seem to indicate, and certainly more than is apparent on the surface.

The machine tool of today is more productive, more sturdy, and more trouble-free than ever before, and the same may be said of cutting tools and equipment generally. Yet, as anyone

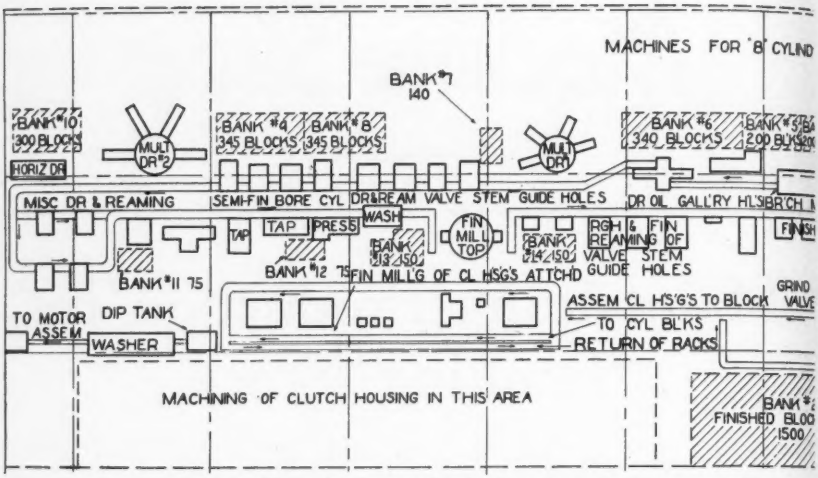
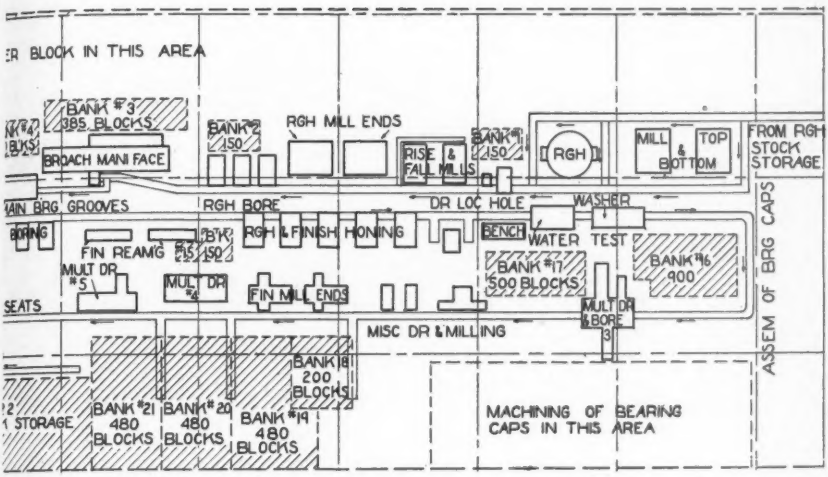


Fig. 1—Floor plan of cylinder department in a large automobile factory

whose responsibility it has been to maintain an even flow of production from the end of a machine line knows, it seems impossible to coordinate all factors so as to obtain continuous production for indefinite periods. Each machine, each tool, and each operator is a potential source of delay from a production standpoint, and even the parts themselves are often at fault.

In an effort to insure continuous production in spite of delays, the planning department of one of the larger automobile plants has retreated a step, one might say, from the point that had been reached in continuous production planning, by providing floor space at certain points in the pro-

No. 2—The Natco progressive fixture type boring machine, with a corner of bank No. 16 showing at lower right. This Natco is one of the key machines in the cylinder block line.

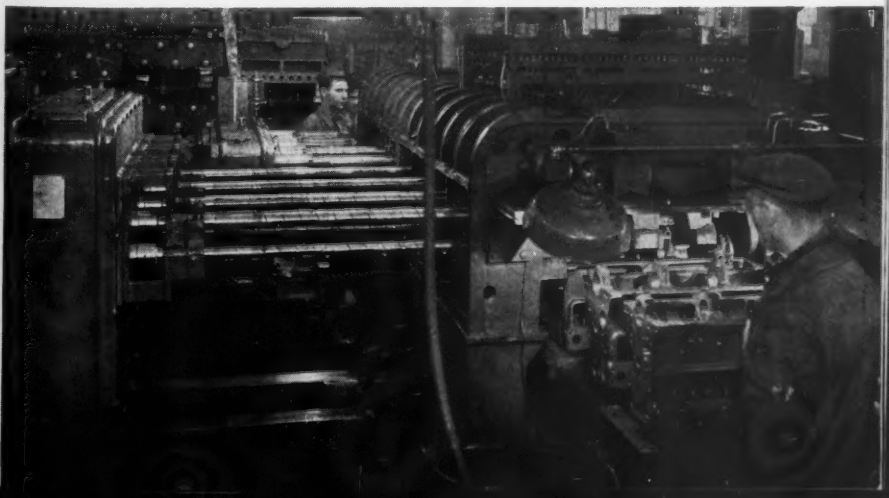


showing arrangement of production machines, conveyor, and storage banks.

duction lines for reserve "banks" of stock. These banks will, in case of breakdown, provide parts for the production line and thus permit production to be maintained, the only loss being for the operation immediately affected. An analogy could be found in a hydraulic line with a number of storage reservoirs from which the liquid could be drawn in case of stoppage in any given section of the line.

Floor space, valuable as it may be, is economical compared to the expense of maintaining extra equipment—and the extra equipment also requires space. The "bank" will, in many cases, become the deciding factor in obtaining maximum efficiency from a given

Fig. 3—View of the Natco progressive fixture type boring machine from opposite side. Bank No. 16 can be seen over the top of the machine.



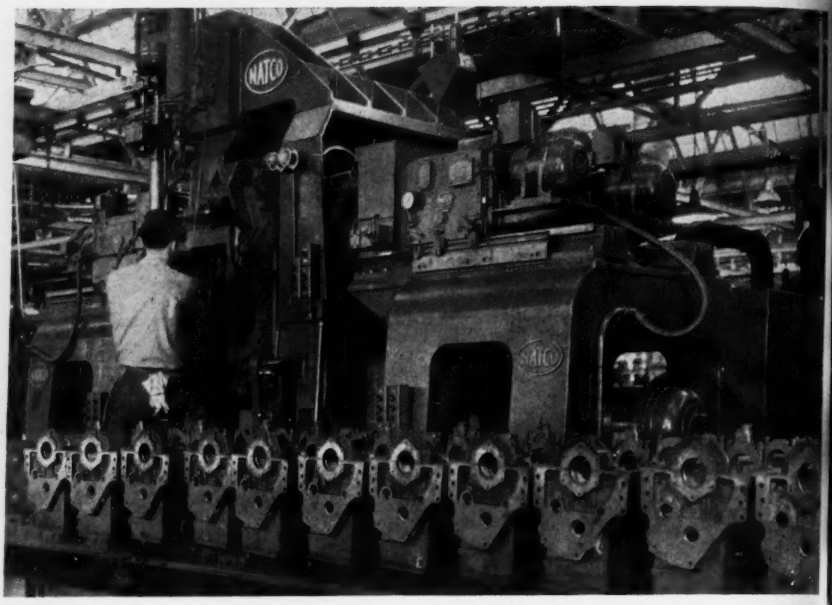


Fig. 4—Natco "drum-type" drilling machine. At the time the picture was taken, a few blocks had "banked" up ahead of the operator.

group of machines; thus consideration should be given to the bank system before new equipment is proposed.

Perhaps no finer example of the advantages of the "bank" system could be found than the cylinder block machine line in the plant to which reference is made. Cylinder blocks, being heavy and bulky, always present a problem from the handling angle, and the machine line is, in this case, relatively long with a number of highly complex machines included. The drawing Fig. 1 is a floor plan of the department, showing the arrangement of the machines, roller conveyor, and storage banks. Incidentally, this arrangement of the equipment, including the "banks," proved successful to the extent of a net gain of 15 per cent in the production over the previous layout.

In making the layout, it was found that the machines varied greatly in size and there was, by necessity, a considerable amount of space left behind the smaller machines. Advantage was taken of these spaces for the banks, and thus the total linear length of the line was not increased. A list of the major operations in sequence, with the "banks" and their capacities is as follows:

Rough Milling of Bottom, Top and Ends
No. 1 Bank—150 blocks
Drill Locating Holes
No. 2 Bank—150 blocks
Rough Boring of Cylinders
No. 3 Bank—385 blocks
Broaching of the Manifold Face
No. 4 Bank—200 blocks
Broaching of the Main Bearing Grooves
No. 5 Bank—200 blocks
Drilling of the Oil Gallery Holes
No. 6 Bank—340 blocks
Multiple-station drill No. 1
No. 7 Bank—140 blocks
Drilling and Reaming of the valve stem guide holes

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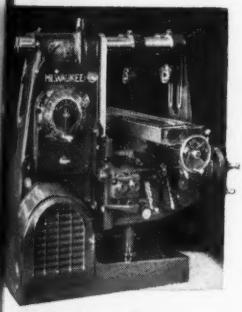

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No. 8 Bank—345 blocks
Semi-finish Boring of the Cylinders
No. 9 Bank—345 blocks
Multiple-station Drill No. 2
No. 10 Bank—300 blocks
Miscellaneous drilling and reaming
No. 11 Bank—75 blocks
Tapping of all holes
No. 12 Bank—75 blocks
Washing, Pressing of valve guides, and Welch Plugs
No. 13 Bank—150 blocks
Finish Milling of the Top
No. 14 Bank—150 blocks
Rough and Finish Reaming of the valve stem guide holes, and Finish Boring and Reaming
No. 15 Bank—150 blocks
Rough and Finish Honing, Washing, and Assembling of Bearing Caps
No. 16 Bank—900 blocks
Multiple-station Drilling and Boring Machine No. 3
No. 17 Bank—500 blocks
Miscellaneous drilling and milling
No. 18 Bank—200 blocks
Finish Milling of the Ends
No. 19 Bank—480 blocks
Multiple-station boring and reaming machine No. 4
No. 20 Bank—480 blocks
Multiple-station boring and reaming machine No. 5
No. 21 Bank—500 blocks
Miscellaneous operations such as hand reaming, pressing in bushings, and grinding the valve seats
No. 22 Bank—1500 blocks (Finished cylinder block storage).

The space for storing the reserves had to be arranged with all the factors of the layout taken into consideration, consequently the banks are, in some cases, smaller than was desired. Bank No. 7 was one of these. Coming, as it does, directly after "multiple station drill No. 1"—one of the key machines in the line—it would be desirable to have a larger reserve. However, the next operations, which are those of drilling and reaming the valve stem guide holes, cause very few delays and so Bank No. 8 was considered to function as part of No. 7.

In general, the largest storage "banks" were located just before and after the key machines, such as the multiple-station multiple-spindle drills shown in Figs. 2, 3, and 4, the hydraulic broaches, and the cylinder boring machines. These machines perform

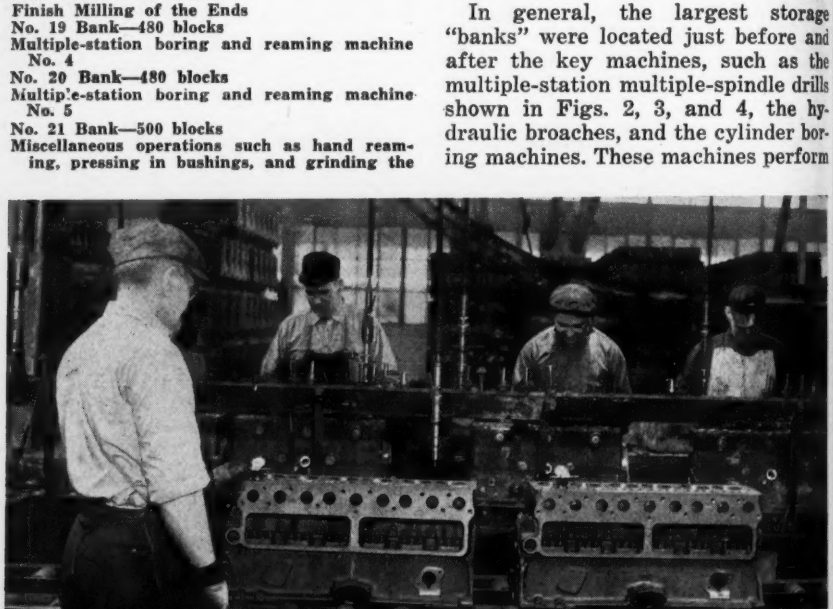

Fig. 5—Valve seat grinding operation, showing a part of bank No. 22 (finished blocks) in the background.

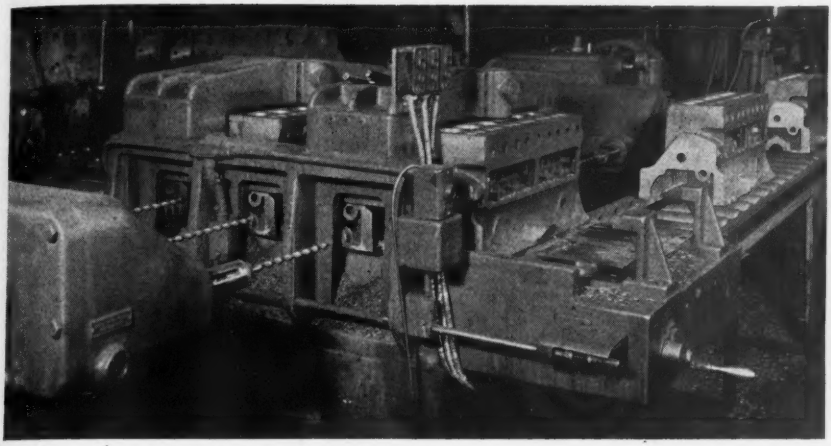

Fig. 6—Two-way horizontal drilling machine with a progressive-type fixture for drilling the oil gallery holes. In the immediate background can be seen part of bank No. 5. Bank No. 4 is the other side of Bank No. 5, but at the time the picture was taken it contained no blocks.

the most exacting operations and require the most care for both operation and maintenance. Conversely, where the operations are performed on single spindle drills, where there is a battery of machines performing identical operations, or where the operations consist largely of hand work, little if any bank is provided. A hand operation of the type referred to is illustrated in Fig. 5.

In addition to the major storage areas, short sections of roller conveyor were placed between the machines in several places. These sections provide for the storage of six to eight blocks adjacent to the main production line for filling in on short delays.

Facilities for handling the blocks with the minimum amount of labor were also carefully studied as an important adjunct to the layout. All of the larger areas are serviced by bridge cranes with air hoists. Spurs of roller conveyor project sufficiently close to the bank areas to reduce the horizontal movement of the cranes. Thus a block can be lifted from a spur of roller conveyor and deposited on the bank pile with a minimum of walking and manual effort.

From the success that has been obtained with the use of "banks" in automobile production, it is the writer's opinion that the use of storage banks will prove a decided advantage in the operation of any long machine line operating on a continuous production schedule. The more such a line is crowded to capacity, the more advantageous the bank system becomes. This fact is even more true when the parts are of a size that compels space consideration for the accommodation of any particular number.

However, the limitations of storage banks must also be carefully watched. They should be truly a reserve, and in no case should they interfere with the regular movement of parts from one operation to another. The effect of tying the operations together so that each operator takes the part in process from the man just ahead of him and delivers it to the waiting hand of the next man is very stimulating when everything is working smoothly. The operations that are most completely mechanized set the

pace and the others must keep up.

If the storage banks can, to some extent, be set away from the main flow of production, the best situation is created. If access to the bank is unimpeded only when the blocks are really needed, the men will be kept from using these blocks when they should be working only on those that are coming through in the normal course of production. In this way the stability of the line as a whole is maintained without fluctuations in the production from any one or group of operations due to differences in the speed of the operators.

The results obtained by the adoption of the "bank" system will, of course, vary widely with the applications. It is only one of the factors in efficient layout, and must be considered along with the length of the line, dimensions of the machines, size of the part, number of close-limit operations, and other factors. Nevertheless, mere floor space, when thus considered, can be a great aid in leveling not only the ebbs and swells, but also the larger surges of production.

What To Do For That Burn

FIRE is used daily in almost every machine shop for tempering, heat treating, welding, forging, in washing machines, drying ovens, and many other places. That burns will occur sooner or later, in spite of all precautions, is practically a foregone conclusion and proper preparation should be made for such an eventuality. A little knowledge may prevent further damage being done and help to simplify matters for the doctor.

Burns are commonly classified according to three degrees: (1) reddening, (2) blistering, and (3) deeper destruction of tissue.

The first impulse of many laymen who have had no training in first aid is to smear the burn with any grease that happens to be handy. While a first degree burn of limited extent may be treated with any of the common burn ointments on sterile gauze, the use of a thick, greasy ointment on a deep or extensive burn will interfere with the doctor's treatment later. Another burn dressing to be avoided is carron oil, which is likely to carry infection. Carron oil is a mixture of linseed oil and limewater, in frequent use in European plants for burns.

Where picric acid, gauze, and clean water are available, a satisfactory dressing can be applied. The gauze should be wet and should be applied several layers thick over the burned area, bandaged in place. Picric acid is a good emergency remedy, but many doctors and surgeons prefer other remedies for continued use.

Tannic acid should be used only in a fresh state, as it will turn to gallic acid if kept standing. To have it on hand ready for emergency, one ounce of tannic acid may be sealed in a glass bottle to be added to one quart of warm, clean water at the first aid station. It may be applied with an atomizer or on sterile gauze pads, the spraying treatment being preferred by most physicians. The solution should be sprayed directly on the burn and on the skin around it. The sprayed part will then turn a dark brown, but the patient will experience a marked relief from the pain.

The spraying should be repeated every fifteen minutes until the doctor arrives, and the treatment is continued at the hospital or at home under the doctor's direction. The spraying treatment is particularly suitable for large areas of skin on the trunk and thighs. For burns about the face and eyes the spray should be replaced by a water-soluble tannic acid jelly.

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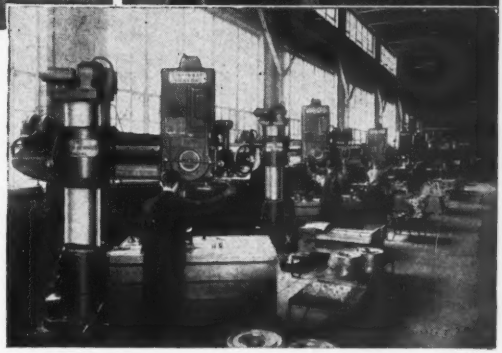

The piece shown is 2¼" x 5¾" x 18½" long.

Operations in sequence include:

1—Drill and Tap four ⅝" holes, two 21/32" holes.

2—Drill and Tap four ½" holes, two 3/16" holes, ½ CT. bore.

3—Drill one 31/32" hole in one end.

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The Bending of Wrought Steel and Wrought Iron Piping

Successful bending of large pipe requires a peculiar skill. This article tells how it is done at the Midwest plant

By George Bange

THE layman on a trip through a refinery, or a distillery, or a large chemical plant soon discovers that he is surrounded on all sides by coils, loops, and curves of huge pipe. If he is mechanically-minded, he soon begins to wonder by what process these loops and bends were made. Anyone who has tried to bend tubing or piping of small diameter has discovered that "you have to know how to do it", and the larger the pipe, the greater the necessity for skill becomes. In such a plant as the Midwest Piping and Supply Co., Inc., St. Louis, Mo., a pipe bender works many years as a helper or apprentice before he is allowed to take charge of a pipe bending table.

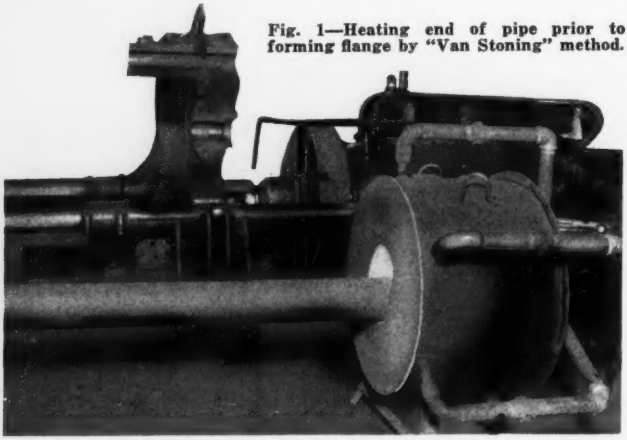

Fig. 1—Heating end of pipe prior to forming flange by "Van Stoning" method.

The principal business of the Midwest Piping and Supply Company is the fabrication of wrought steel and wrought iron pipe, which includes bending, coiling, flanging or lapping, and welding. This work is done to the customer's drawings and specifications and covers everything from a simple pipe bend or coil to a completely-fabricated power plant, chemical plant, or refinery installation. In addition to the pipe fabrication, this company manufactures a complete line of welding fittings, and both fittings and pipe are shipped to practically all parts of the world.

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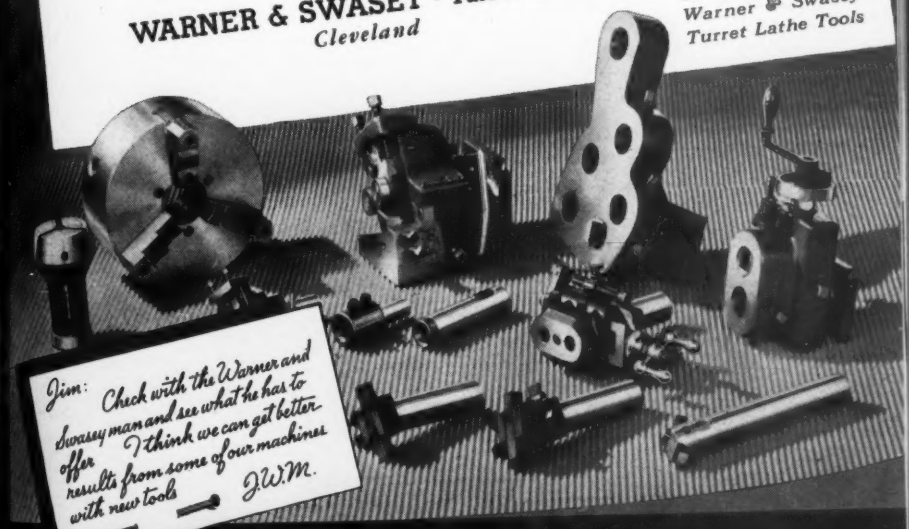

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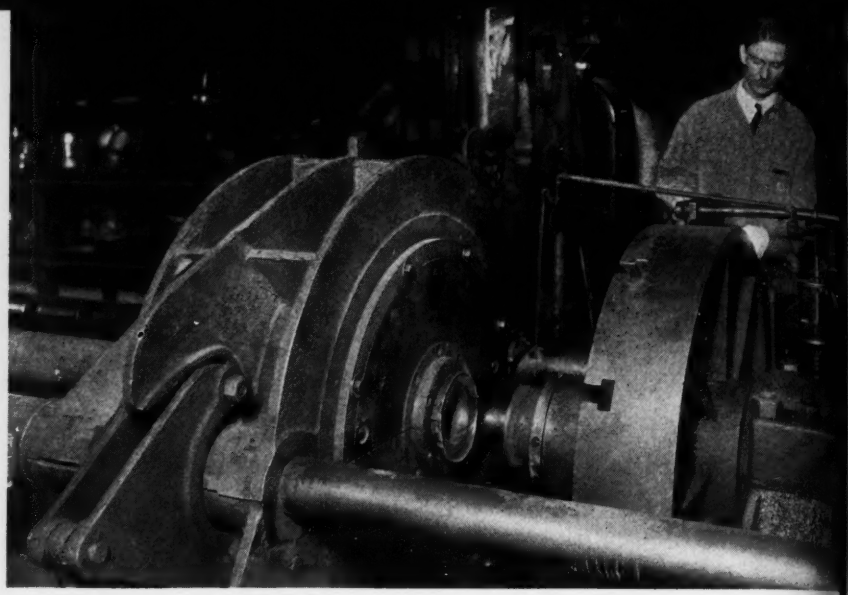


Fig. 2—Van Stoning machine with pipe in position.

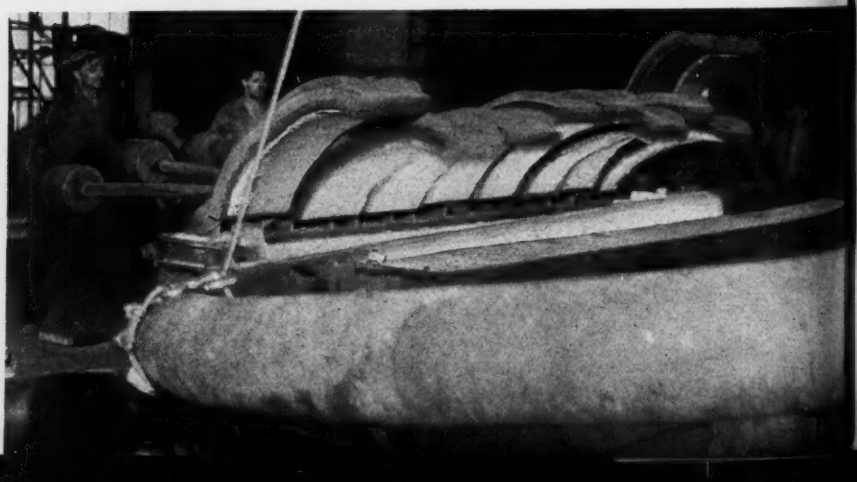
The standard specifications for lap-welded and seamless steel pipe for high temperature service calls for minimum tensile strength as follows: Welded pipe.....45,000 lb. per sq. in. Seamless pipe,

grade A .....48,000 lb. per sq. in. Seamless pipe,

grade B .....62,000 lb. per sq. in. Thus it can easily be seen that whatever bending or fitting may be required, these specifications must be met. Bending operations on pipe that is 18 in. or 22 in. in diameter are a common occurrence, and bends have been made in pipe of 30 in. diameter.

The pipe shop has four bays, each of which is served by a traveling crane. In addition, motor operated jib cranes are located where they will be accessible to the machines and bending tables. There are several

Fig. 3—Pipe heating furnace with pipe in position. The top of the furnace is made in sections which are counterbalanced so that any part or all of the top of the furnace can be opened. The pipe shown has been heated to a white heat at the part which is to be bent.



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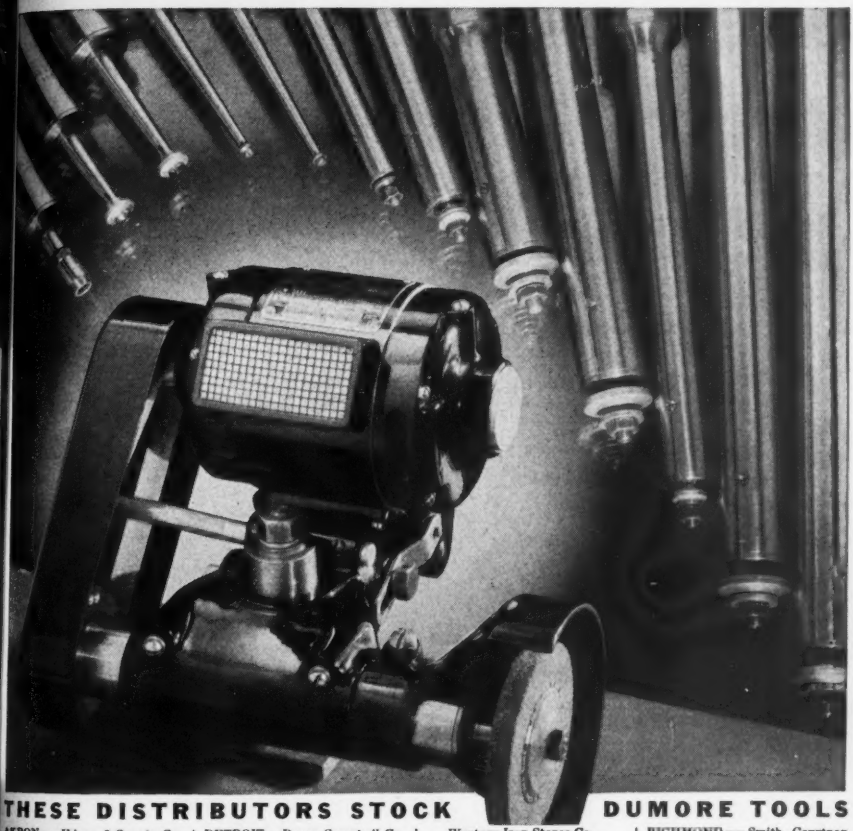

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tables of various sizes, each of which has its own furnace for heating the pipe, and power capstan to pull the cable when the pipe is in position for bending.

Large and heavy pipe intended to withstand high pressures and high temperatures when fabricated is usually made up with flanges on the ends so that several lengths can be bolted together. The flanges are formed by rolling the end of the pipe, after heating, under pressure. This method of forming flanges is known as "Van Stoning", after the originator of the method, and the machine is called a Van Stoning machine.

Before placing the pipe in the machine for Van Stoning, the end of the section is heated to a cherry red heat in a gas burning furnace such as that shown in Fig. 1. The Van Stoning machine can be seen in the rear. As can be seen, the furnace is of cylindrical shape, consisting of a steel drum lined with fire bricks. Eight burners are used, being spaced equally about the exterior and located toward the front end.

A close view of the Van Stoning machine, with a length of pipe locked in the machine, is shown in Fig. 2. The flange has already been formed by the Van Stoning process. To form the flange, a "wabbler" is anchored to the faceplate of the machine and power is applied to revolve the spindle while at the same time power is applied to force the wabbler into and against the end of the pipe so that the soft, hot end of the pipe will be spread by a sort of spinning process. The wabbler, indicated by the arrow, is hinged on a universal joint and at the same time is off-center from the center of the spindle so that as it re-

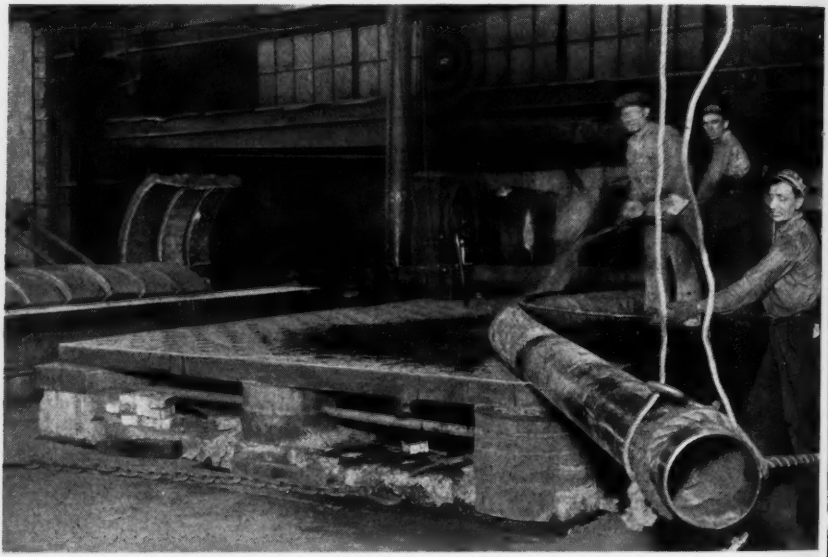

Fig. 4—The pipe bending operation in process. The pipe is bent to fit the templet, water being applied to cool the pipe and control the bending. By bending, then cooling, then bending again the desired curve is obtained.

volves, it also bears against the wall of the pipe in the inside and spreads the metal until the flange has been formed. The face and edges of the flanges are finished by turning in a lathe.

As everyone knows who has ever bent any pipe or tubing, it is practically impossible to bend pipe and hold it to its original cylindrical form. As a pipe is bent, the natural tendency for the metal on the outside of the curve is to flatten against the inner wall, rather than stretch; thus it is practically impossible to bend a hollow pipe empty without having a "flat" at the curve.

To avoid this difficulty and force the pipe to retain its cylindrical form, the pipe is filled with some substance which will force it to retain the cylindrical shape and at the same time allow the metal on the outside of the bend to stretch. The most common filler is sand and it is sand that is used on these large pipe sections. Before placing the pipe in the furnace to be heated, one end of the pipe is closed and the pipe is then stood either on end or vertically at an angle of 45 degrees—usually depending upon the length of the pipe—and sand is poured into it from an overhead hopper. When the pipe is practically full, the open end is also closed and the pipe is ready for heating and bending.

To bend a large pipe section, that portion of the pipe that is to be bent is heated in a furnace especially designed for this purpose. The furnace is of long, low construction and gas is used as fuel, thirteen gas burners being set into one of the walls and close to the bottom. The top of the furnace, as shown in Fig. 3, is made of sections, counterbalanced and hinged so that any part or all of the top of the furnace can be opened in order to insert or remove a pipe. The illustration shows the top of the furnace completely open and cables slung around the pipe—which has been heated to a white heat—preparatory to removing it from the furnace and placing it on the bending table. The pipe is hoisted, of course, by an electric crane.

Fig. 5—The amount and speed of pull on the pipe is controlled by tightening or slackening the rope around the constantly revolving capstan.

Figure 4 shows the actual bending of the pipe. The bending table is of cast iron, approximately 4 in. thick. Holes of 2-in. diameter are arranged in rows approximately 8 in. apart so that steel plugs can be inserted at practically any point in the table to block the pipe and hold it in required positions for bending. The overhanging portion of the pipe is, as shown in the illustration, suspended by cable from the overhead crane and the actual pull to bend the pipe is exerted by a rope cable attached to the pipe and wound around the capstan shown in Fig. 5. The capstan revolves con-

Fig. 6—Pipe of 4- diameter or les bent cold in this m chine.

tinuously, the amount of pull on the cable being controlled by the operator. A slight tightening of the rope around the capstan by the operator is sufficient to exert a tremendous pull at the other end of the rope, and by experience he has learned to know just when to pull and when to slacken the rope so as to bend the pipe the exact amount required.

One of the workmen in Fig. 4 can be seen holding a templet which has been made by bending a rod to the exact curve required. The templet can be made up ahead of time and thus no time will be lost in bending the pipe to the required arc after it has been heated. Even on very large pipe, such as shown in Fig. 4, bends are made within very close limits.

With the steel plugs holding the pipe at the rear end and the cable pulling on the front end, a great deal of skill and many years of experience is required to control the bend. The man in charge of the bending table can be seen standing on the table with a hose in his hand, spraying water on the bend as the operation proceeds so tha the bend will b made in exact the right spot.

Another bendin table is shown i Fig. 6. This one however, is mostly used for bendin pipe cold, whic can be done wit certain kinds o pipe up to 6-i diameter. Th rollers are anchor ed to sliding sections of the tabl which makes it possible to adjus the rollers so as to obtain any radiu required. The rollers are, however removable and inasmuch as roller having different radii must be use for the different sizes of pipe, there are complete sets of four rollers each for all of the different sizes in use.

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"The Last Ten-Thousandth"

By Bartlett West

Fig. 1—Sunnen Hones in a variety of sizes.

REMOVING stock on a part for a device or mechanism of average size can be done down to within a few thousandths of an inch within reasonable limits of cost. As the limits of accuracy are tightened, the cost increases and thus it often costs more to remove the last thousandth of an inch of material than it did the first eighth of an inch.

The record of civilization's progress is a record of constantly increasing demands —demands for mechanical devices to relieve hand tasks—demands for better mechanisms to supersede those of more crude design—demands for mechanical devices to make life easier—and demands that all of these things shall operate efficiently, automatically, and silently. And the demand f smooth, quiet operation of m chanical units is becoming i creasingly imperative.

Time was when an automobile cou be heard coming blocks away. Tod the cars roll by so silently that t motor cannot be heard. Until recen ly the word "streetcar" was synony mous with "noise"; today streetca are built that run almost silentl Practically all of these improvement can be credited to closer limits of de

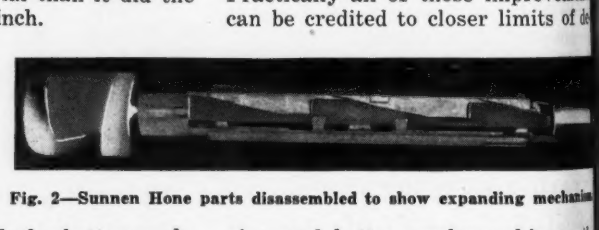

Fig. 2—Sunnen Hone parts disassembled to show expanding mechanism

sign and better workmanship on th parts involved. Where limits of per haps 0.005 to 0.010 inch were allowe a few years ago, 0.001 to 0.002 inc is the rule today. Limits of 0.001 o 0.002 inch of a few years ago hav

been reduced to perhaps 0.0002 inch today, and so on.

It is obvious, of course, that finer limits mean finer workmanship. It is impossible to measure over a coarse cut in terms of ten-thousandths of an inch; as the limits are tightened, the quality of the finish must be improved accordingly. Thus in developing ways and means to work to close limits, it has been found that one of the best ways to remove the last bit of surplus stock, do it economically, and obtain the necessary quality of finish, is by abrasion. In other words, by the use of accurately made and accurately controlled abrasive stones. With a tool in which such stones are employed, the last ten thousandth inch of surplus stock can be removed economically and without great risk of spoiling the work.

Abrasive stones have been used for hundreds of years for removing infinitesimal amounts of stock, such as, for instance, in the sharpening of knives, swords, and other cutting edges. The advantages inherent in the abrasive stone were recognized when the cylindrical grinder was developed for producing a smooth finish on exterior surfaces of cylindrical-shaped metallic parts. Grinding for close accuracy and fine finish on exterior surfaces has been customary for perhaps a couple of centuries. More recently abrasives have been used in the form of laps for the finishing of interior surfaces, but it has been only within the last fifteen years or so that scientifically-designed, mechanically-controlled tools in which straight sections of abrasive stones are held have been used for this purpose.

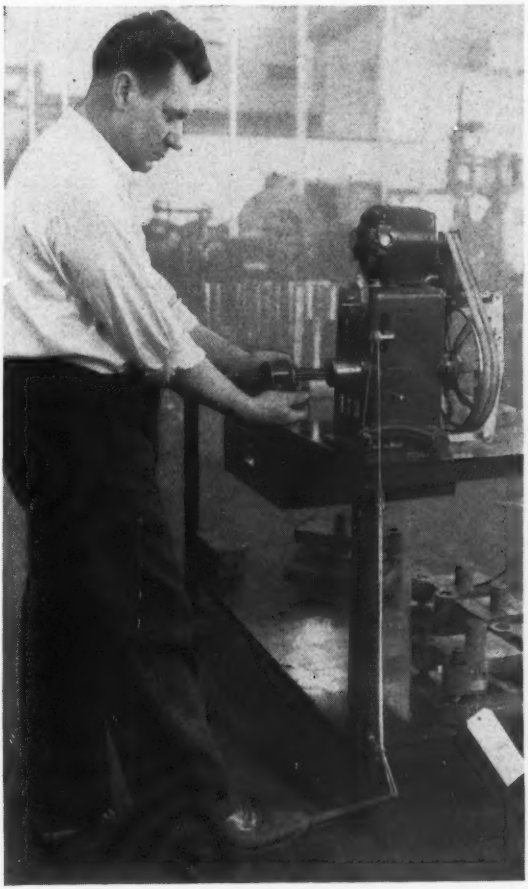

Fig. 3—Sunnen Honing Machine in operation.

Today the advantages of these tools—commonly known as hones—are well known and honing tools of the better class are used in all

branches of industry for the finishing of interior surfaces in all kinds of products from small bushings to large engine cylinders.

A representative tool of this type

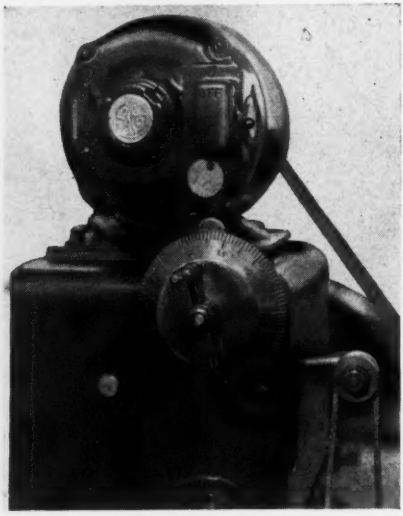

Fig. 4—Close view of setting dial on Sunnen Honing Machine.

is the Sunnen Hone, shown in Fig. 1. The tool or mandrel is shown here in four sizes, to illustrate the manner in which it can be adapted for various sizes of work. These mandrels each carry one stone that is attached to an expanding holder and is guided by two solid cast guide shoes. The smallest size hole that can be honed is 0.375 in. diameter and the largest, up to this time, is 2.400 in. diameter. These hones will work in all metals except babbitt with an accuracy of 0.0001 in. for roundness, straightness, and taper in holes 0.375 in. to 0.720 in. dia. x 4 in. long, and in holes from 0.720 in. to 2.400 in. dia. x 7 in. long.

The hone shown in Fig. 2 has been partly cut away to show the mechanism by which the expansion is obtained. When used in the Sunnen Honing Machine, shown in Fig. 3, the expansion is controlled automatically by the machine according to whatever setting is made on the dial at the front of the machine. A close-up view of the dial is presented in Fig. 4.

Each stone is held in its own holder, upon the sides of which are three projections that engage the three tapered surfaces of the wedge, as shown in Fig. 2. When the shank of the mandrel engages the spindle of the honing machine, the end of the wedge locks with an adjusting link which is controlled by a foot lever, shown in Fig. 3. Pressure on the foot lever moves the link horizontally and thus operates the wedge, which in turn expands the hone. Full pressure on the foot lever will expand the hone to its maximum setting; by adjusting the dial at the front of the machine, shown in Fig. 4, the setting of the stone can be adjusted by ten-thousandths of an inch.

When the operator is ready to pro-

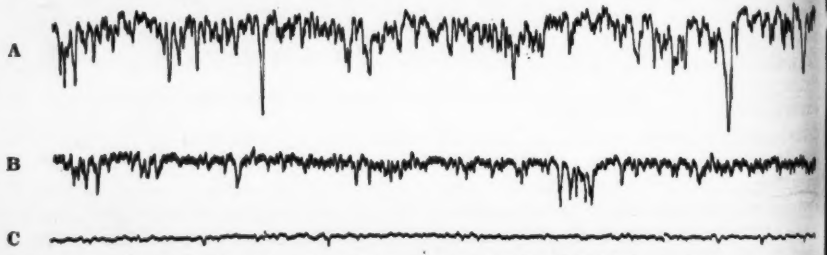

Fig. 5—Profilographs of bored, rough honed and polished hole surfaces.

ceed with the job, he selects the size of mandrel and grade of stone best suited for the task in hand, locks it in position in the honing machine, and then adjusts it, by means of the dial, until it will just fit the hole that is to be finished. With the machine in operation, the workpiece is moved back and forth over the hone until the hole has been finished to the maximum diameter afforded by the setting of the stones. If the hole is still too small, the adjustment is corrected by means of the dial and the honing operation proceeds. This operation is repeated until the hole is finished to the desired size.

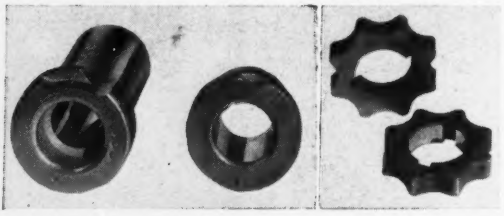

Fig. 6—(Left) The finish and accuracy required in drill jig bushings can only be obtained economically by honing. Fig 7—(Right) An example of carburized steel parts that are finished to fine limits by the use of the hone.

As pressure on the foot lever is released, the link moves backward, pulling the wedge with it and allowing the stone to "collapse." As pressure is applied to the foot lever, the link is projected, pushing the wedge with it and forcing the stone to the maximum diameter afforded by the setting of the dial. Thus, after a setting has once been made, the stone will be expanded only the amount desired when the foot pedal is pressed down and, accordingly, all the workpieces can be finished to size at maximum speed, the only setting required being that necessary to compensate for the wear of the stones.

Ordinarily, where there are several thousandths inch of stock to be removed from a hole, a roughing stone is used to remove all but the last fraction of a thousandth and then this stone is changed for a finishing stone. Where a large quantity of pieces of the same kind are to be finished, it is customary practice to rough all of them first and then finish all at the same time. It is important that the last cut in the hole be very light. The finishing stone can be used immediately following the machining cut where the cut is smooth enough so that the desired finish can be obtained by the removal of not more than 0.001 in. of stock. Where a highly-polished finish is desired, a polishing stone is used after the finishing stone. The stones are never used dry; lard, oil or special grease in stick form is applied to the stone surfaces frequently in order to obtain the best results. Dry stones wear rapidly.

A good idea of the different types of surfaces that are produced by the use of different types of tools is afforded by the reproductions of the profilographs presented in Fig. 5. The instrument with which the profilograph record is made consists primarily of a very fine diamond point, which moves over the surface to be recorded, and a series of lenses and mirrors which reflect and magnify the movement of this point onto a sensitized paper. The profilographs shown here represent the surfaces of various types of a cast iron cylinder wall magnified 2000 times in depth and 30 times in length.

The profilograph A is a record of a surface that has been finished with a single cutter boring bar, the record being made after the second cut. Profilograph B is a reproduction of the same surface after being ground with Sunnen roughing and finishing stones.

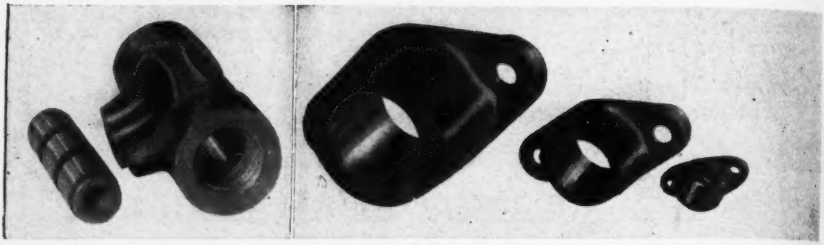

Fig. 8—(Left) Approximately 0.004 inch of stock is removed from this hole, producing a mirror finish within 0.0002 inch limit in from two to three minutes. Fig. 9—(Right) These Morse Chain Couplings are finished within 0.00025 inch of drawing size, removing 0.004 inch of stock.

Profilograph C is the same surface after being processed with Sunnen roughing, finishing and polishing stones. The polishing stones left a "mirror" finish.

As an example of the precision tasks for which the hone is used, note the "Universal" Drill Jig Bushings shown in Fig. 6. These bushings are of hardened tool steel and the holes are finished to a mirror finish, within 0.0001 inch of specified size. This finish and this accuracy can be obtained by the use of the hone at a manufacturing cost which makes these bushings economical for all jig users.

The rotor blanks shown in Fig. 7 are processed five at a time, the keyways being staggered so as not to damage the stones in the hone. These blanks are made from SAE 4615 steel, carburized, and the holes, which are 3/16 inch long, are finished 0.525. Approximately 0.002 inch of stock is removed in the operation and the diameter is held to limits of 0.0002 inch.

Figure 8 shows a cast iron vibrator body with a hole 2 inches long and 0.625 inch diameter. From two to three minutes time is required to remove 0.004 inch of stock, producing a highly polished finish within limits of 0.0002 inch. Figure 9 presents several of the couplings that are used in fabricating the Morse chain. The couplings are of mild steel. The hole in the large coupling is 2¾ inch long and 2.250 inch diameter; the hole in the middle coupling is 1-7/16 inch long and 1.375 inch diameter, and the hole in the small coupling is ¾ inch long and 0.625 inch diameter. Approximately 0.004 inch stock is removed from each one of these holes and the diameter is held to a limit of 0.00025 inch in all cases.

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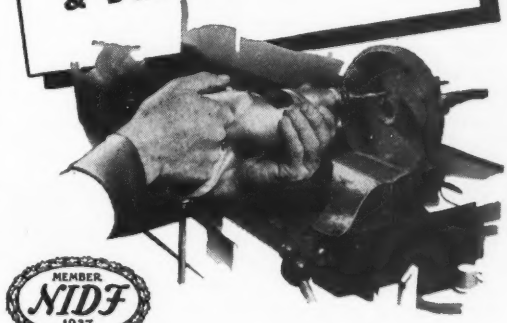

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High Speed Steel

The second article of this series, dealing with the physical properties of high speed steels and the factors which affect cutting ability

By J. P. Gill

Chief Metallurgist, Vanadium-Alloys Steel Company, Latrobe, Pa.

ALL high speed steels are of a segregated nature, consequently the distribution of the segregates has considerable effect upon the characteristics of the steel. The segregate referred to, shown in the microphotograph, Fig. 1, is of the cast structure of steel A, referred to in Table I of the previous article as containing .55-.75 per cent carbon, 18.00 per cent tungsten, 4.00 per cent chromium, and 1.00 per cent vanadium. An analysis of this segregate showed that it contained about 3.00 per cent carbon, 4.5 per cent chromium, 65.00 per cent tungsten, and 4.5 per cent vanadium, the remainder being iron.

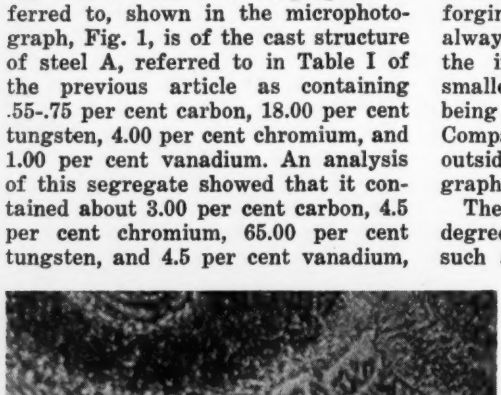

Fig. 1—Microphotograph of the cast structure of steel A in Table I, referred to in the previous article of this series. Analysis of the segregate showed that it contained 3.00% Carbon, 4.5% Chromium, 65.00% Tungsten, and 4.5% Vanadium; remainder, Iron.

The distribution of this segregate will depend upon the melting and casting practice to partially control it in the ingot, and then upon subsequent forging and rolling. The segregate is always larger toward the center of the ingot, which cools slower and smaller toward the outside due to being chilled by the wall of the mould. Comparisons of the center with the outside are shown in the microphotographs Fig. 2 and 3.

The larger the ingot, the larger the degree of segregation, other factors such as temperature of the casting, mould design, and so on, being the same. The amount of reduction obtained in the forging and rolling may not indicate the segregate distribution, since in producing a 1-in. round from a very large ingot, no amount of forging or rolling will break up the segregate as well as starting with a smaller ingot having a smaller segregate and giving it less reduction in rolling and forging. This segregate cannot be broken up by heat treatment. It can be partially dissolved by heating to a high temperature, but on re-annealing will appear in substantially the same areas, unless the tem-

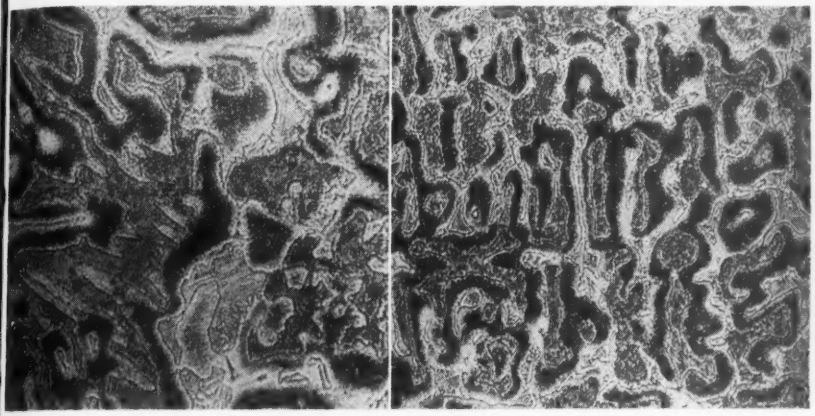

Fig. 2 and 3—Comparisons of structure of the center (left) of a high speed steel ingot with the structure near the outside (right).

perature has been so high as to fuse it. After solidification of the ingot it can only be distributed by mechanical work.

Hammering will tear the segregate apart to a varying degree, while rolling or pressing will simply elongate the segregate without materially breaking it up. Hammering is, therefore, considered a necessary operation in the manufacture of high speed steels. This segregate, actually a eutectic, has a lower melting point than the remainder of the steel and will fuse while the steel appears to be in a solid state. The segregate will fuse at temperatures only slightly above that used in heat treating, and when the segregate fuses, the steel will have something of the appearance of the cast structure indicated in Fig. 4.

It is not easy to select the physical properties of a high speed steel that will in all cases determine its adaptability for a specific operation. We have a vague idea that it must have cutting ability and should have the toughness but we usually think of these properties only as in comparison with some other steel. Most of us think of cutting ability as the most necessary requisite of a high speed steel, so let us try and enumerate some of the factors or characteristics which determine cutting ability.

First—ability to resist softening at elevated temperatures, or in other words, red hardness. This is a most important property in a high speed steel since there is some temperature point at which the cutting edge of any high speed steel will become so soft that failure will take place immediately. This temperature varies considerably with different steels, but, in general, those steels that are most highly alloyed have the highest resistance to softening at elevated temperatures.

Harder and Grove investigated the hardness values of different high speed steels at elevated temperatures. A few of the hardness values they obtained are indicated in Table II. The conclusions of Harder and Grove as to the hardness of high speed steels at elevated temperatures are fairly consistent with the cutting properties as indicated in production.

Harder and Grove stated that a

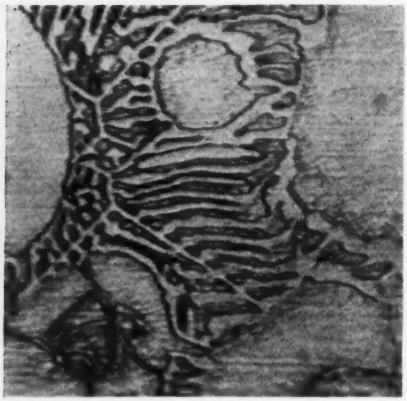

Fig. 4—Microphotograph of structure of fused segregate in hammered high speed steel. The segregate has a lower melting point than the rest of the steel and will fuse at a temperature only slightly above that used in heat treating.

temperature of 1290 deg. F. appeared to be the most desirable temperature for hardness testing as a possible means of predicting cutting efficiencies. They stated that vanadium is effective in contributing hot hardness; that the 18-4-1 type is superior in hot hardness to a steel not containing vanadium, but that the 18-4-2 type shows higher red hardness values than the 18-4-1 type; that cobalt added to any of the types further increased the hardness but that a cobalt content over 5.00 per cent did not seem to further increase the hot hardness (which is not consistent with cutting tests); that the addition of molybdenum did not increase the hot hardness of the steel, and that steels in which tungsten is wholly replaced by molybdenum have shown lower hot hardnesses.

Another excellent indication as to the temperature at which a steel will begin to soften is that of the tempering temperature to which the steel may be heated without loss of hardness. This varies from a low of about 1000 deg. F. for a molybdenum high speed steel to a high of about 1140 deg. F. for some of the most highly alloyed steels.

Second—Strength and Toughness. It is generally conceded that strength and toughness in high speed steel are most important physical properties and for certain classes of tools probably are of more vital importance than wear resistance or resistance to softening at elevated temperatures. The property of toughness varies over a wide range in the different types of high speed steels and, for that matter, even within the same type of high speed steel when the carbon content, grain size and segregate distribution are varied. It has been proven that

TABLE II

Hot Hardness of High Speed Steels

Steel	Quenching Temp. Deg. F.	Tempering Temp. Deg. F.	Brinell Hardness at Elevated Temp. Degrees Fahr. 570	750	930	1100	1290
A 18-4-1	2350	1050	650	640	560	455	170
B 14-4-2	2300	1100	570	555	500	435	250
C 18-4-2	2350	1050	635	570	540	445	280
E 9% Mo. No W.	2150	930	610	590	565	465	150
G 18-4-1 +5% Co.	2350	1050	670	640	600	510	305
H 18-4-2 + 8% Co.	2400	1100	655	625	570	500	295
J 21-4-2 + 13% Co.	2400	1050	650	645	610	555	305

the failure of cutting edges of many types of tools is the result of minute chipping, thereby causing a building up of friction and pressure and resultant failure. This is distinctly noticeable in some of the cobalt high speed steels which are notoriously brittle.

Most of us do not have a very clear conception of toughness, possibly due

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to the fact that toughness in itself implies three distinct properties; namely, strength, deformation within the elastic limit or elasticity, and deformation beyond the elastic limit or plasticity. Different physical tests

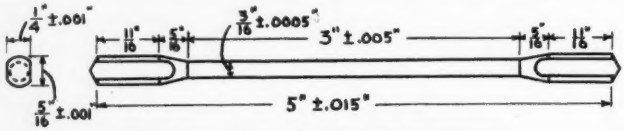

Fig. 5—Drawing of Torsion Test Specimen

have been proposed for testing the toughness of high speed steels. Izod and Charpy tests are so inconsistent as to make them of little value. Something of an innovation on the impact test was proposed by Luerssen and Green in their so-called torsion impact.

The static torsion test has been known and used for many years by most makers of small tools such as taps and drills. Often times the equipment for torsion testing has been of a home-made nature, and the tester has been primarily interested in comparing one material with another without any effort to arrive at any value that could be stated in a mechanical or physical term which would have any meaning to anyone not familiar with the method of testing. Emmons proposed a standard specimen for static torsion testing and suggested the term "coefficient of toughness" which was obtained as the product of the force or ultimate torque and the degree of twist. In making torsion tests using the method proposed by Emmons, one can obtain a diagram which is remarkably valuable in that it clearly shows the strength and plasticity of steels in the fully hardened condition.

The dimensions of the test specimen proposed by Emmons are given in the drawing, Fig. 5, and Fig. 6 is a typical chart showing how the results are plotted. In this chart the torque in inch-pounds is plotted as the ordinate and the angular deformation, or twist in degrees, is plotted as the abscissa. The dimension AB is termed "elastic deformation," and the dimension BC is termed "plastic deformation." Strength within the elastic limit is indicated by the dimension DE, and the ultimate strength is shown by the line CF.

The effect of carbon on the strength and plasticity of an 18-4-1 steel is disclosed by the diagram, Fig. 7. The actual strength of the material would be indicated as long as the line remained straight; where the straight line breaks, the elastic limit of the material has been exceeded and plastic

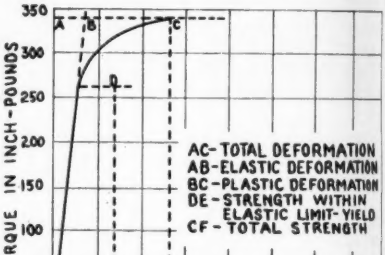

Fig. 6—Diagram showing how torsion test results are plotted

deformation has begun.

It may be more valuable for a steel to show high strength and small plastic deformation rather than low strength and high plastic deformation. For example: let us assume two high speed steel taps, one with high strength and small plastic deformation, and the other with low strength

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and high plasticity. The high strength tap may withstand torque to which it is subjected in the tapping of a hole and thus will not be bent, but the other tap, having high plasticity and low strength, may bend immediately when subjected to the torque necessary in order to cut the threads, and is, therefore, useless.

Third—Resistance to wear. The ability of a high speed steel to resist wear is certainly of great importance in determining tool life. This property of high speed steel is most difficult if not impossible to determine with any degree of accuracy and reliance. A number of different types of machines have been designed for wear testing, and it is probable that no two people conducting these tests have ever made them in the same manner. Testing may be of a rolling or sliding nature, with or without an abrasive or lubricant. The same metal may be tested in contact with itself or with another metal. When no abrasive is used one may be formed anyway as the product of the wear. This may be essentially iron oxide, or it may even have some carbides present when high speed steels are tested.

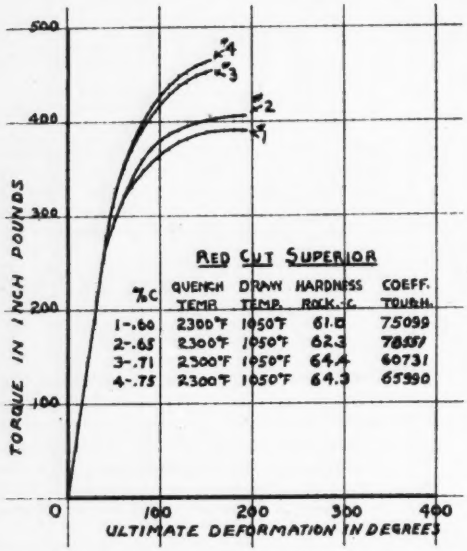
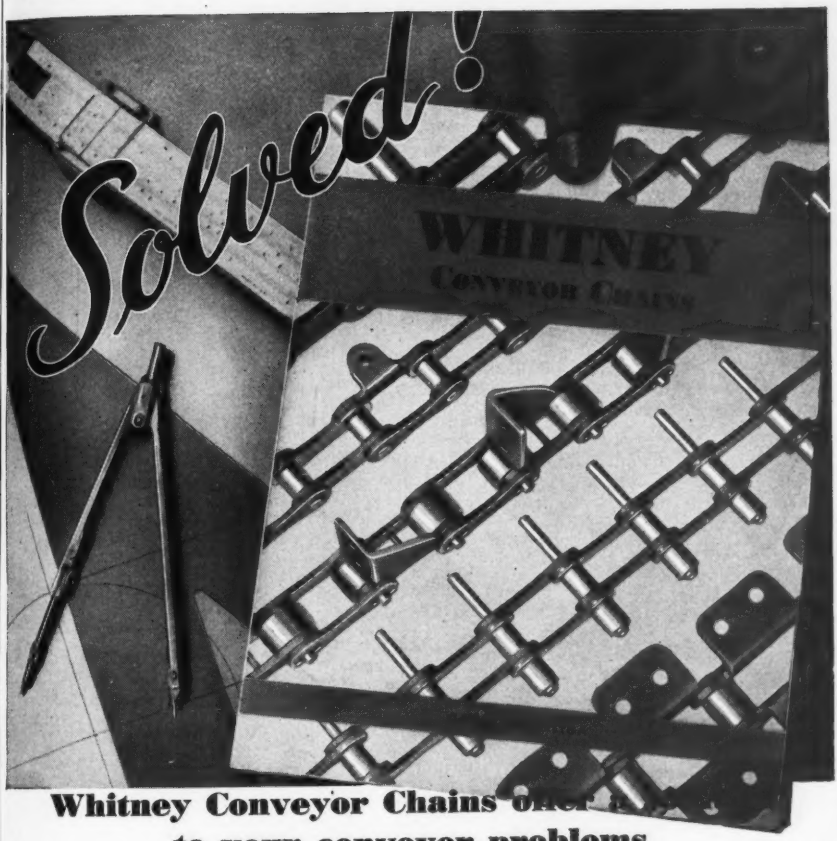


Fig. 7—Diagram showing effect of Carbon on strength and plasticity of an 18-4-1 high speed steel

It is well known that certain types of comparatively soft steels may show better resistance to wear than the same steels when hardened, due to a change in structure and hardening of the surface by plastic deformation. This cold working of the surface of a tool in operation may be one explanation as to why results in cutting tests may vary 200 and 300 per cent, using the same steel with the same heat treatment and cutting the same material. Steels which show superior resistance to wear against another metal may not show the same results at all when the metal is changed for a different metal. Observation as to cost of grinding finished tools of the several different steels is a practical method of obtaining some knowledge as to their wearing qualities.

It is probable that the factor of resistance to wear or abrasion is some product or summation of the hardness and plasticity of a material, thus anything we do to increase the plasticity of a material is probably also increasing to some degree its resistance to wear. It is well known that as we increase the temperature of hardened steel within certain limits we are increasing its plasticity. Different high speed steels may, therefore, have a different factor of toughness at different temperatures and consequently their resistance to wear at any temperature under the softening point may vary considerably with variation in temperature. This may explain in part why highly-alloyed cobalt high speed steels usually show



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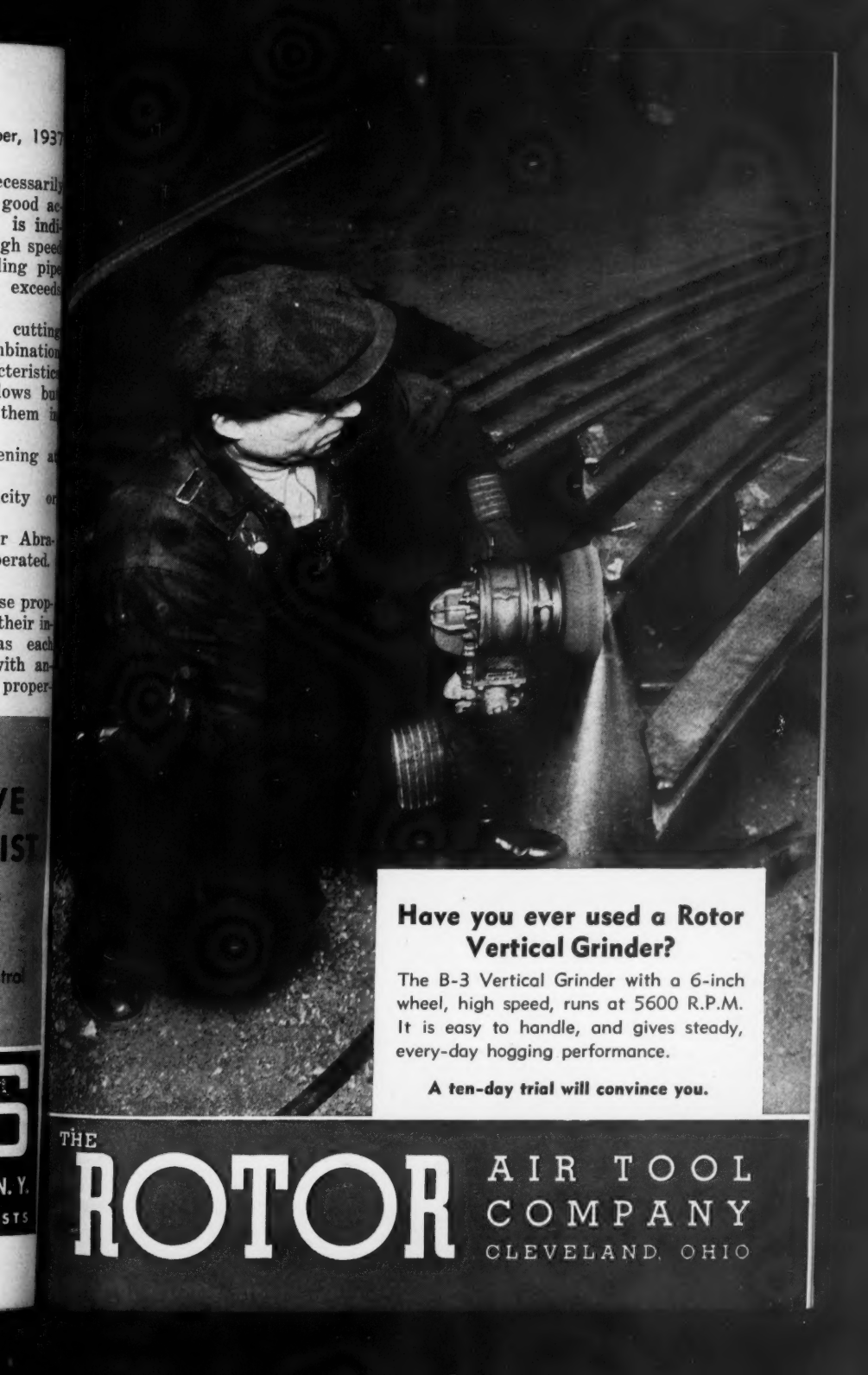
much better results when tested under conditions where considerable heat is generated at the cutting point.

Fourth—Hardness. Hardness is an important physical property in high speed steel, one which is easily determined, and a property which is sometimes used as a measure of the toughness of a material since it is generally assumed (but not necessarily true) that as the hardness increases, the toughness decreases, and vice versa. In most instances cutting ability will increase with the hardness, but this is not always true, either. It is well known that with the cobalt high speed steels it is almost a necessity to have them intensely hard in order to obtain the best results. It is also interesting to note that during the last few years the average hardness of tools made of high speed steels has crept upward, possibly due to the use of better machines and more rigid set-ups. High speed steel tools need not necessarily be intensely hard to give a good account of themselves, which is indicated by certain classes of high speed steel chasers used in threading pipe where the hardness rarely exceeds C 60 Rockwell.

It is obvious then, that cutting ability is dependent on a combination of different physical characteristics which we may name as follows but without regard to ranking them in importance:

1. Ability to resist softening at elevated temperatures.
2. Strength and Plasticity or Toughness.
3. Resistance to Wear or Abrasion at temperature operated.
4. Hardness.

It is difficult to separate these properties one from another as to their influence on cutting ability as each bears a direct relationship with another. All of these physical proper-



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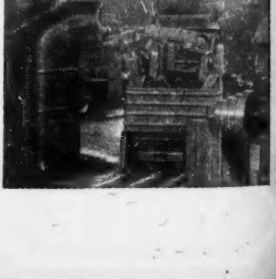


Reducing Costs With Welded Jigs and Fixtures

By N. Warshaw
Chief Engineer, Lewis-Shepard Co., Watertown, Mass.
As told to Francis A. Westbrook

THE Lewis-Shepard Company manufactures products which can be used in almost all industries, provided the necessary variations are made to adapt them to the specific requirements peculiar to each. The result is that we must have a great many standard types and sizes, which in one line, at least, run up to well over seven hundred. With us, consequently, it is impossible to reduce costs of production by cutting down the number of standard items, and economies must be made in other ways in order to be able to sell at a reasonable price to our customers, and build up a good volume of business.

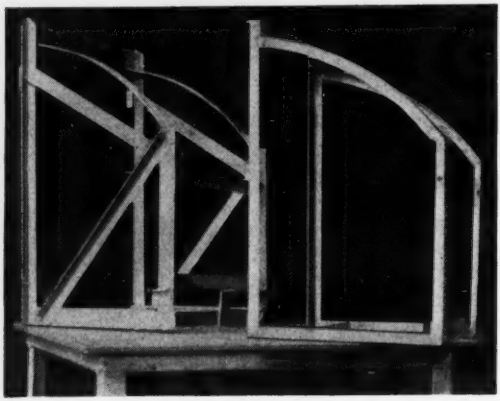


Fig. 1—Drum Pouring Stand of Welded Construction

One of the greatest aids in the accomplishment of this very necessary result has been the extensive use of jigs and fixtures. And as electric welding plays a very important part in the fabrication of our products we have found that by employing this versatile tool we can make our own jigs and fixtures very inexpensively and greatly reduce manufacturing costs. Moreover, these jigs are used for both machining and welding operations.

Of course the case for welded jigs has been adequately presented before, but the manner in which it fits into our method of operation may be suggestive of possibilities to others. All practical means of reducing costs are worth while, no matter what line of industry is involved.

It is pretty generally known that jigs and fixtures speed up work and that they make for the interchangability of parts. However, unless the number of parts to be produced is large, the cost of jigs and fixtures is not usually justified, and the manufacturer gets along without them as best he may—generally at the expense of higher costs. But if some method of making them at a very low cost is available, the benefits to be derived are possible even where comparatively few parts are to be made. That is where making them by means of welding comes in with us. It is true that we have the important advantage

of having a very complete welding department as a part of our production equipment, and a corps of skilled welders, but we are far from being alone in this at the present time.

What we actually do is to fabricate

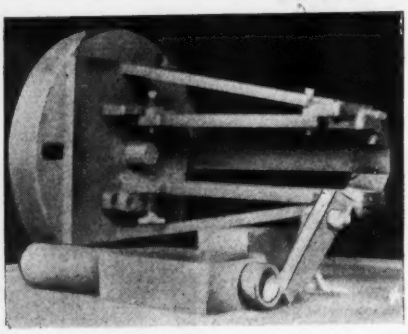


Fig. 2—Lathe Fixture formed by Welding.

jigs and fixtures from pieces of machine steel by means of electric welding. Naturally this is a very different matter from making patterns, molds and castings which must be machined. The only trick about this is to make them square, and this is done by securely clamping the pieces in place and then welding a little at a time, working all around the joints so as to avoid uneven heating. This, of course, means that they are not expensive to make. It is not even necessary to make preliminary drawings, for the foreman of the welders is capable of making them from the drawing of the part in question.

In addition to the great advantage of cheapness, our experience has shown that there are other advantages which can be credited to welding. For instance, in the development of a new type of product, when the stage has been reached where it becomes desirable to make a dozen or so similar pieces, a jig is justified because of its low cost. If some change in the design of the item becomes necessary, as is very likely to be the case in development work, it is a simple matter to change the jig by cutting, or by the addition of parts. Thus it is possible to make a first jig knowing that minor changes can be made later without altering the important dimensions. A new jig would almost surely have slight variations in dimensions from the original so that the parts made from the two would be lacking in ready interchangeability.

The foreman in charge of assembly work, in which welding as a fabricating tool is employed, knows better than anybody else in the shop how the jigs for welding operations are to be used. Since making up jigs by means of welding is such a simple operation, as compared with cast jigs this foreman is able to design them better than a draftsman who cannot know the practical details as well. It is also a part of his responsibility to see to it that he has the most efficient means for his assembly work, so that this matter of providing jigs is quite properly a part of his job.

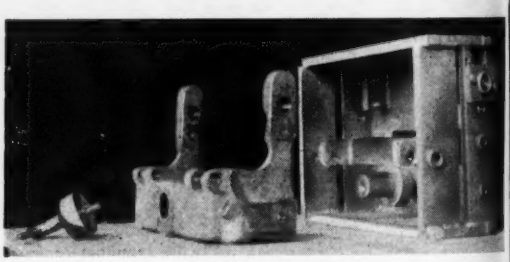


Fig. 3—Lift Truck Head Casting and Welded Jig in which It is Drilled

Furthermore, as already hinted at, it is not merely a question of welded jigs being easy to design, but they are made in the same way as many

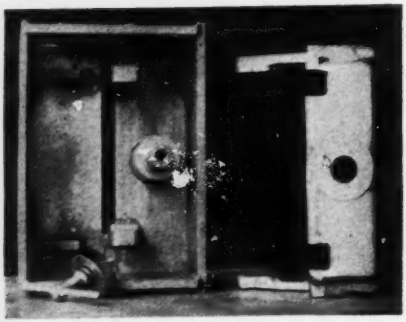


Fig. 4—Interior of Jig Shown in Fig. 3, Showing that Smooth Surfaces are Obtained without Machining

of the welded items in the production schedules, so the foreman is on familiar ground. He usually just makes a rough sketch from the working drawings and the welder works from this. This same foreman, being a versatile old-timer, also designs the jigs and fixtures used for machining parts in production.

The fact that jigs can be made quickly and inexpensively means that they are very extensively used, and we have them in the shop for almost every conceivable operation. We practically never have duplicates and they never wear out before the item becomes obsolete.

Another important advantage of welded jigs and fixtures is that many of the items fit against an inside surface which would be difficult to machine, if it were a casting, because of inaccessibility. With the welded construction, made up of pieces of machine steel with true surfaces, this internal machining is not necessary. Very often with a cast jig where the internal surface cannot be reached for machining, the piece has to be made separately and the parts bolted together. This, of course, is likely to result in inaccuracy. Or if the jig is dropped, the bolted type is more

likely to be damaged than the solid type. It is also true that the welded jigs are stiffer and far less liable to chatter, as well as being lighter in weight for a given strength.

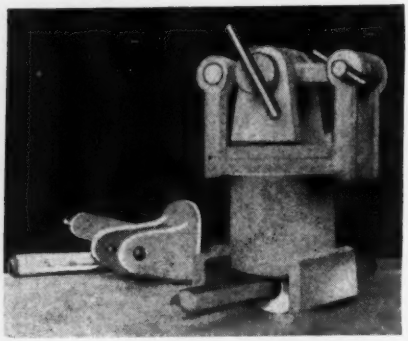


Fig. 5—Welding Fixture for Fabricating Handle Fork for Lift Truck. This Fixture is also of Welded Construction.

A few examples of some of the welded dies and fixtures in use in our shop will illustrate most of the points in the foregoing discussion. Fig. 1 shows a drum pouring stand which is very simply made up of a few pieces of steel, bent into shape and welded. An equally simple jig was made to facilitate fabrication. The jig is the same shape as the product, except that it is somewhat larger, so that the metal strips of which the stand is made fit inside of it.

The stand is made of lengths of angle iron bent into shape and with the sides notched to permit of bending properly, one strip for each side. These pieces are set in the jig (at the left). The only clamps needed are at the ends, and all measuring and squaring is eliminated. The cross pieces are merely laid in place. The inside of the stand is then welded and it is taken out of the jig and the outside welded. The jig costs very little to make and the manufacture of the product is greatly simplified.

Fig. 2 shows a fixture of welded construction, intended for use on the face plate of a lathe. It is both light and rigid, and is of a type which would hardly be practicable to make in the form of a casting. It is used for the boring, reaming and tapping of each end of the hydraulic release check head for certain types of lift trucks. The shape of this piece is odd and this is about the only reasonably convenient way of holding it in a lathe. With this arrangement it is a very easy matter to do the work on one end of the part and then take it out, turn it around and work on the other end. Like all of the fixtures, this was comparatively inexpensive to make and is a great operating economy.

Another jig of welded construction is shown in Fig. 3. This is for drilling the casting for the head of a lift truck. It is made so that five holes can be drilled in each end without

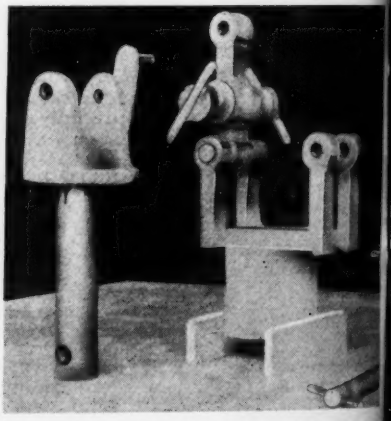


Fig. 6—The Welding Fixture Shown in Fig. 5 with the Workpiece Removed and Standing at the Left of the Fixture.

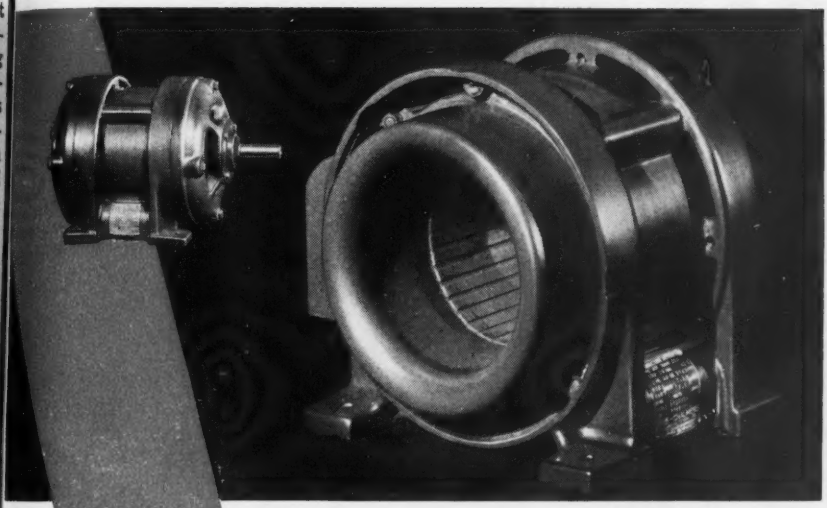
removing the part from the jig. The whole thing is simply drilled on one end and is then turned over for the drilling of the other end. One of the

holes in each end varies for different sizes of the product and this is provided for by having the bushing through which the drill passes arranged in a slot so that adjustments are possible. This jig is a good example of heavy welded construction with true inside surfaces obtained without machining, and against which the part can be pushed for proper indexing. It would be extremely difficult, to say the least, to machine the inside if this were in one piece. Another view of this jig is shown in the illustration Fig. 4.

In Fig. 5 is shown a welding fixture of welded construction for fabricating the handle fork for a lift truck. The fork is made of several pieces of steel welded together and these are held in place in the fixture for the welding process. Of course the fork might be forged, but this would be much more expensive than welded fabrication, which is made so easy by the fixture. The fixture also insures accuracy, so that the interchangeability feature is not lost.

These examples could be multiplied at great length but the few which have been given serve to show some of the most important features provided by the employment of welding. Of course a full set of jigs and fixtures is not required for every model and size of product as many of the parts are interchangeable for several sizes, and slight variations can be handled as described in the jig for drilling the head with the adjustable bushing.

Lewis Automatic Wire Straightening and Cutting Machines Bulletin No. 2-C-37. A general description of the Lewis No. 1-C, 2-C and 7-C Automatic Wire Straightening and Cutting Machines is contained in a four-page folder now being distributed by The Lewis Machine Company, Cleveland, Ohio. Photographs of the three different types of machines are included, together with a table of specifications. Copy free.



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Modern Equipment at Work

Remington Rand Improves Parts and Reduces Costs with G-E Electric-Furnace Brazing

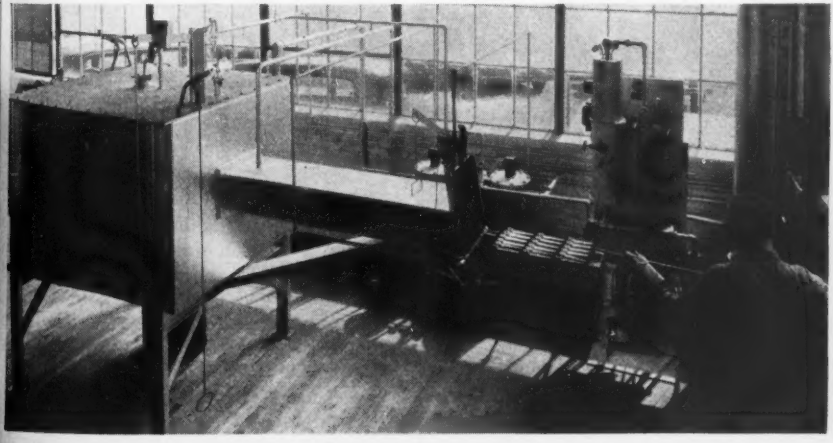
THROUGH the use of a small, G-E batch-type electric furnace for the copper-brazing in a controlled atmosphere of more than 150 different kinds of machine parts for adding and accounting machines, the Dalton-Powers Division of Remington Rand, Inc., is making substantial savings in production and service costs. The strength, quality, and life of the parts have been materially improved by the process. Four of the parts provide particularly good examples of the advantages afforded by the electric-furnace method of brazing.

When the "tubular subtraction wheel" was fabricated by riveting, it was the source of many service complaints. Now, spotted in position and electric-furnace brazed, its strength is materially increased. There are no rivets to come loose, and service costs are cut.

Formerly, the "total link arm" was stake-pinned and torch-brazed. The driving force necessary in pinning often changed the slot dimensions. Now, the part is press-fitted and electric-furnace brazed, with the result that time is saved and strength increased.

The "handle hub and driving arm" assembly was formerly held together by four riveted pins which sometimes loosened and resulted in service complaints. The parts of the assembly are now press-fitted, spotted, and electric-furnace brazed—and, as a result, rejects are entirely eliminated, service costs reduced.

The "handle drive shaft" assembly, previously spot-welded and torch-



G-E Electric Furnace Brazing Equipment used for brazing adding machine parts. The furnace is 20 KW, 12 in. wide x 6 in. high. The heating chamber is 38 in. long and the cooling chamber is 60 in. long.

brazed, is now press-fitted in position and electric-furnace brazed. The vibration and severe impacts that these parts have to withstand in everyday service sometimes worked the joints loose and made replacements necessary. With the electric-furnace—brazed assembly, however, strength is greatly improved and freedom from complaint on vibration-loosened joints realized.

The equipment used for this work consists of a General Electric controlled - atmosphere, copper - brazing furnace and a G-E combustion-type furnace atmosphere controller. The furnace, 12 inches wide and 6 inches high, has a heating chamber 38 inches long and a cooling chamber 60 inches long. It is rated at 20 kw.

Special Vise Jaws Hold Work Firmly Without Marring

HOLDING work in the ordinary type of vise is a simple matter as long as the work has parallel sides, or at least parallel points that can be gripped between the jaws, and when all the pressure necessary can be applied to keep the work in position. But when the work is of irregular shape, or if the surfaces have been polished, or if the structure of the workpiece is fragile, a simple matter immediately becomes an important problem.

The problem is usually solved, however—after a fashion. The mechanic starts a search for something from which soft jaws can be made, and usually comes back with some pieces of sheet copper or brass which, with much chiseling and hammering, he fashions into coverings for the vise-jaws. These copper "jaws" afford a certain amount of protection for the polished surfaces of the work, but do not go far toward solving their problem of holding the irregular pieces.

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IN THE SHOP . . . .

A Starrett No. 25-T2 Dial Indicator checking the setting of teeth in a Hypoid Gear Cutter — one of hundreds of applications in which Starrett Dial Indicators are set up on machine tools, production jigs, fixtures, etc.

ON THE INSPECTION BENCH

For quick, accurate inspection of duplicate parts. A Starrett No. 25-A Dial Indicator set up in a special fixture for testing thread chasers. Indicators can be furnished with Revolution Counters, Indicators can be furnished with Shock Resisting Mechanism and similar features when required.

Starrett Dial Indicator Catalog MD (Second Edition) illustrates and describes the entire line of STARRETT and LAST WORD Dial Indicators. A copy sent free on request. Write for it.

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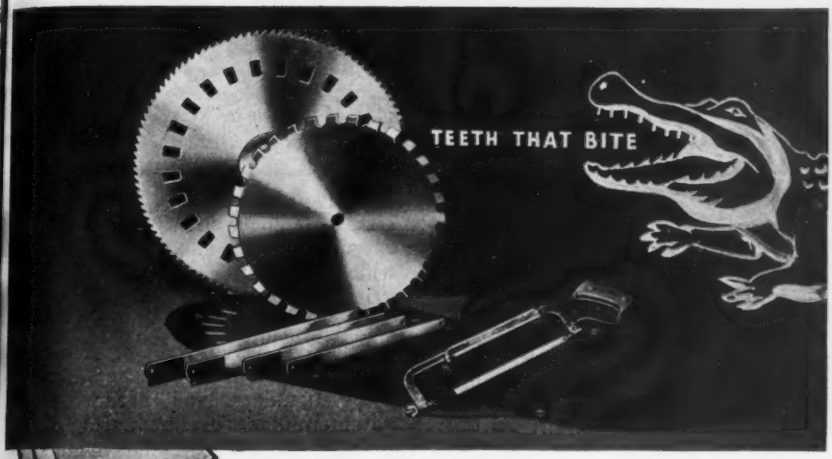
The illustration shows a mechan working on a piece of work that held between Cornelius Q-D (quic detachable) jaws which have been ap plied to an ordinary vise. The work piece is of circular shape and thu

Q-D vise jaws make it possible to hold wo of any shape without danger of slipping marring.

would be difficult to hold between th steel jaws of the vise, but it is he firmly between the Q-D jaws, whi are also of circular shape.

A set of Q-D jaws includes jaws four different styles; semi-roun which are padded, for holding circ lar parts; V-jaws, with slots runnin both horizontal and perpendicula straight padded jaws for holding po ished work, and bevel jaws, whi have an advantage in certain instan ces. The jaws are easily slipped in place and are held in position counterweights which rest on the re slopes of the vise-jaws.



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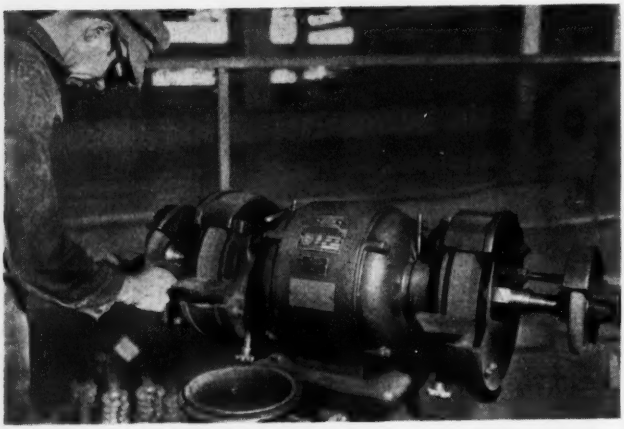
Ideas from Readers

This department is a clearing house for ideas . . . If there is a "kink" or short cut in use in your shop, send in a description of it . . . Each one published will be paid for.

Increasing the Efficiency of a Floor Grinder

By R. B. Loveland

THE illustration shows how the efficiency of a Black & Decker Heavy Duty Floor Grinder was practically doubled, at the Roanoke shops of the Norfolk & Western Railway, by the addition of an extra pair of grinding wheels.



Grinding a radius in a tire forming tool. With the extra wheel, both straight surfaces and radii can be ground on the same machine.

There are a number of operations in a locomotive shop—particularly the wheel turning operation—for which form tools are required, and quite a bit of time can be saved if the tool grinder can transfer his work from one wheel to another without the necessity of walking back and forth between grinders. To achieve this result, the grinder shown was fitted with extension shafts and a pair of wheels which could be dressed for radius grinding, thus providing a flat surface wheel and a radius wheel at each end of the machine.

The radius wheel spindle is a short shaft shouldered and threaded at the outer end for wheel mounting in the same manner as the regular spindle. The opposite end of the shaft is bored and threaded internally to fit the thread on the end of the regular machine spindle, the outside being milled hexagon to provide for a wrench, as shown. When tightly screwed onto the spindle, the extension serves both as a spindle for the extra wheel and also as a nut in place of the usual nut. A stud carrying a wheel guard completes the assembly. A wheel guard is easily fabricated from heavy sheet steel, cut to provide the necessary parts, and welded together.

With this equipment the tool grinder can grind a straight surface on the flat-face wheel and immediately transfer the work to the radius wheel for radius grinding.

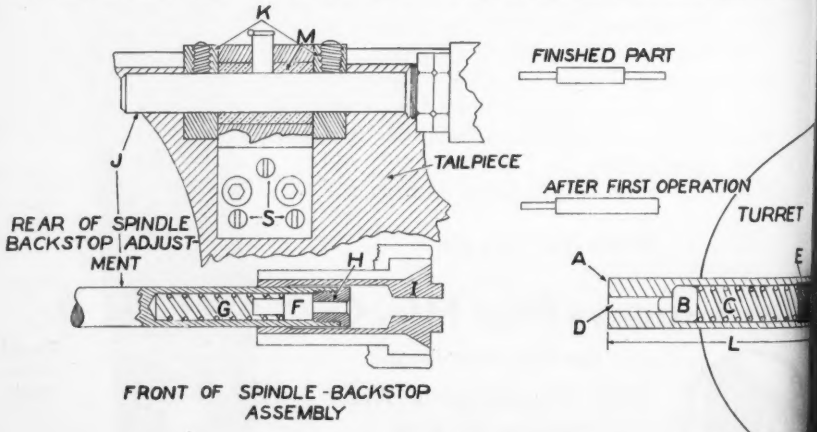
Second-Operation Loading Device for Automatic Screw Machines

By Walter G. Porter

THE device shown, which was built in our own plant, has been used with great success on both No. 00 and No. 0 B & S Automatic Screw Machines. The design incorporates features which eliminate the bugbear of hand-operated single-cycle second operations on short run lots of pins and screws similar to that shown in the drawing. In using this set-up in the production of the part shown, on 10,000 pieces a total saving of 45 per cent was made over a previous lot of the same size when the old single-cycle hand-loading method was used.

The device consists of two major parts; the loading finger A and the collet chuck I. The loading finger A is made to a diameter that will be a push fit in one of the holes in the turret. From the rear the loading finger is drilled to take the plunger, B, which is held in place by the spring C. The spring was No. 20 (B & S gauge) wire, coiled to make a spring 9/16 in. diameter with four coils to the inch. The spring was locked in position by the threaded plug E, which was counterbored to form a seat for the spring. The hole D was reamed to a slip fit for the workpiece. The length of the loading finger, indicated at L, should be all that the set-up will permit, in order to permit the maximum of spring length with consequent fuller movement of the plunger.

The spring collet I should be of a size to suit the diameter being gripped, which, in this case, is the large diameter of the workpiece. The backstop rod, J is of ½-in. cold rolled steel of suitable length to project at least four in. beyond the extreme rear end of the spindle. The front end of the backstop rod is drilled to take the spring G and the plunger F, and is also tapped for the plug H. The compression spring G is of No. 24 wire (B & S gauge) coiled to form a spring ⅜ in. in diameter with five coils to the inch. The spring plunger F is a sliding fit in the hole in which it is located. The plug H should be threaded with an Alemite thread, and the hol



Drawing of Second-Operation Loading Device for Automatic Screw Machine

through the plug should be approximately 0.015 in. larger than the small diameter on the finished end of the pin.

The thrust adjustment collars K are 1 in. diameter x ½ in. in width x ½-in. hole. Setscrews bearing against the shaft J provide adjustment both for end play and to determine the length of the stop at the front end of the spindle. The bronze bushing M is a bearing for shaft J. Shaft J is keyed to the spindle by a small steel pin which is filed to fit the keyway in the spindle.

The machine is set to load continuously, and as the turret indexes around to bring the loading finger into upright position, the operator inserts a semi-finished piece. At that instant the collet opens and the part that has just been completed is ejected. The loading finger now indexes to horizontal and advances to the collet. The spring within the loading finger advances the part into the collet, against the backstop, and at this point the collet closes. The machining operations follow and the operation is repeated.

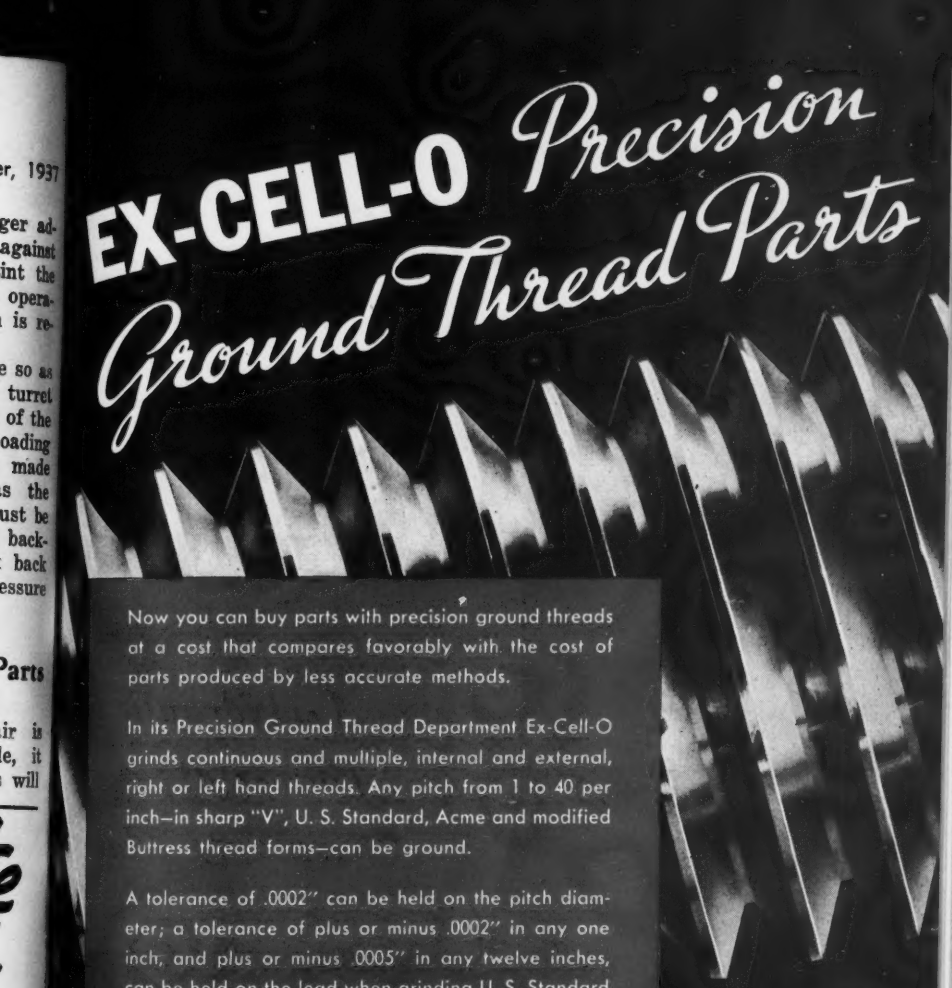
The lead cam should be made so as to permit movement of the turret slide up to and beyond the face of the collet. The springs in the loading finger and backstop should be made according to specifications, as the spring in the loading finger must be stronger than the spring in the backstop so as to force the blank back against the stop, against the pressure of the ejection spring G.

Flippers for Stripped Parts

By Chas. H. Willey

ALTHOUGH compressed air is pretty generally available, it sometimes happens that a press will

EX-CELL-O *Precision Ground Thread Parts*



Now you can buy parts with precision ground threads at a cost that compares favorably with the cost of parts produced by less accurate methods.

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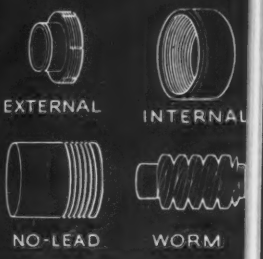
Let us show you that Ex-Cell-O can economically produce your parts with greater accuracy. Send us your blue prints; we will be pleased to furnish a quotation promptly, without obligation.



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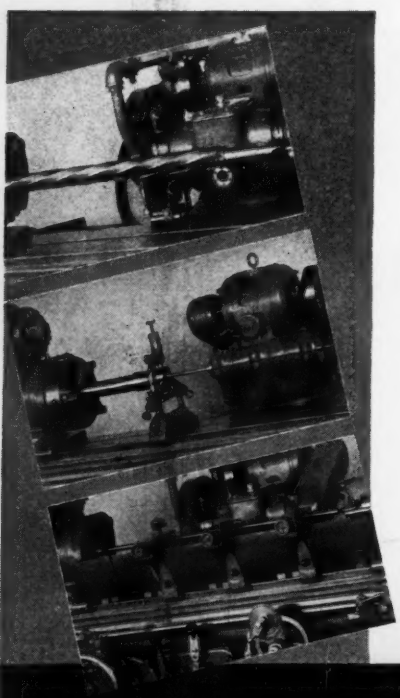
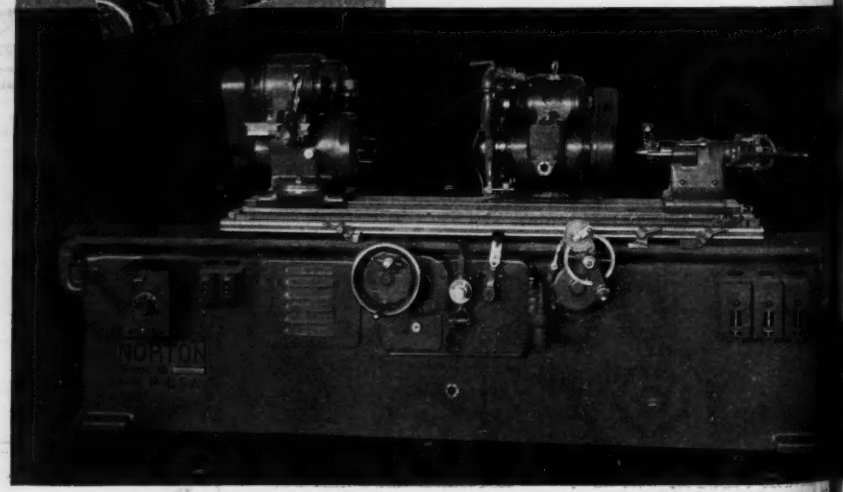


The New NORTON MULTIPURPOS

A Hydraulic Universal Grinding Machi



be located where air is not available and thus other means must be provided for clearing a die of stripped

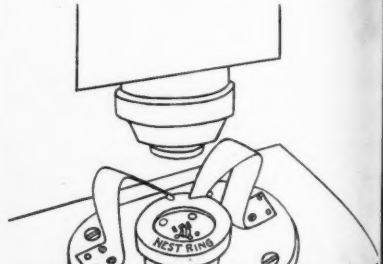


Fig. 1—Drawing illustrating design of "flippers" for keeping die clear of stripped parts

parts. The drawings illustrate a method that has been used successfully by the writer. To illustrate the design of the tool, a workpiece A is used, but the idea can be used on

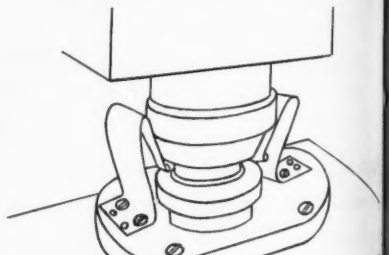


Fig. 2—As the punch descends, the flippers are spread apart.

work of a variety of designs.

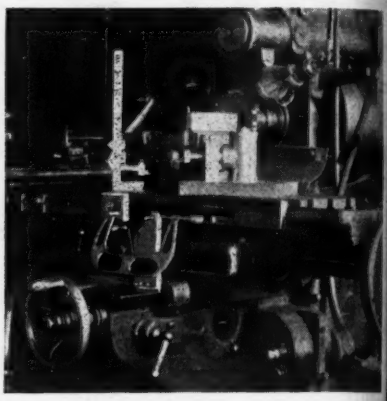
In the example shown, the workpiece is punched and divided. This part is used in the building of laminated lagnets, and is of 0.062-in. magnet steel. The feature of the tool is the pair of flippers, which can easily be identified by the reader. As the punch descends, the flippers are spread by the tapered portion of the punch as shown in Fig. 2. When the punch rises, it carries the workpiece with it until it reaches the top of the stroke at which point the workpiece is stripped off. As it drops, it falls on the ends of the flippers, which have now sprung back again to form a guard over the nest ring of the die. The flippers being slightly twisted, the workpiece is "dumped" to the rear, clear of the die.

Simple Device Promotes Accuracy in Precision Boring

By Russell G. Howard

THAT every possible precaution is taken by the manufacturers of the present-day milling machines to ensure the accuracy of those machines is quite obvious. However, whether in a large shop or a small one, there will be times when a device such as the one illustrated here can be used to advantage.

The device consists of two hardened plates, each provided with screw holes by which it can be anchored to the machine table, and each having a hard-



This photograph shows the precision measuring device in place on the milling machine, together with micrometer used to take the measurements.

ened and ground pin over which measurements may be taken with the micrometer. Plate "A" has a tongue which fits into the slot in the front of the machine table and thus helps to locate and hold it. A counterbored screw hole makes it possible to secure the plate to the table by using the same screw that is used to hold the stops in position. Plate "B" is anchored to the front of the transverse slide as shown in the photo-

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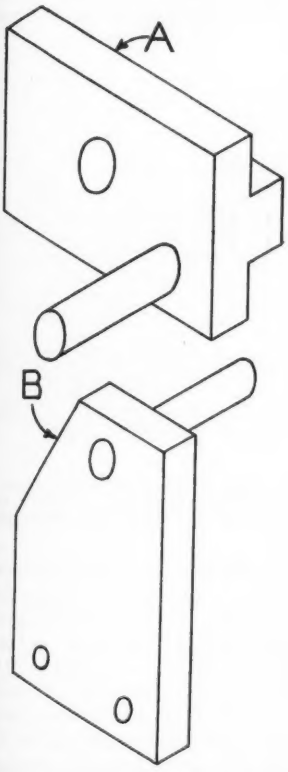
graph. When the plates are properly anchored, the pins are at the same height; thus it is a simple matter to measure over the pins with a micrometer of the correct size. However, when the machine table is moved, the



Drawing of the plates "A" and "B", comprising a precision measuring device for the milling machine.

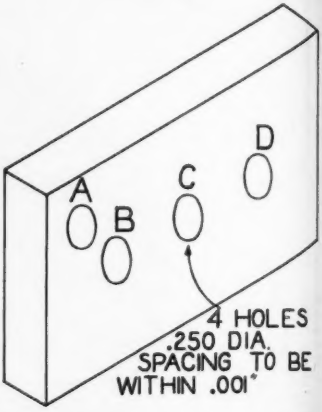
distance between the pins is varied accordingly.

As an example of the advantage of such a device, let us assume that we are to bore several holes in a jig or master plate, the holes to be spaced within limits of 0.001 in. The job is to be done on a milling machine equipped with the plates referred to. The first move is to square the fixed jaw of the vise with the machine-spindle, and the second is to clamp the plate in the vise in a vertical position; that is, standing on its side. The third action consists in inserting a stub arbor or plug into the machine spindle. The plug must, however, run true.

To obtain the first measurement, which is the distance from the end of the plate to the center of the hole A, the table is moved endwise to bring the end of the plate into contact with the plug. Taking the diameter of the plug into consideration, the distance from the end of the plate to the center of the spindle is easily obtained. At this point, the plate "A" is placed in position on the front of the machine table, within measuring range of plate "B", and clamped. It is now a simple matter to take the measurement across the pins and add to this amount the distance the table must be moved

in order to obtain the precise location of the first hole.

The vertical dimensions can be obtained in the same manner. Plate "A" is designed with the pin offset so that the plate can be reversed to bring this pin high enough to clear the pin in plate "B". However, in the case of



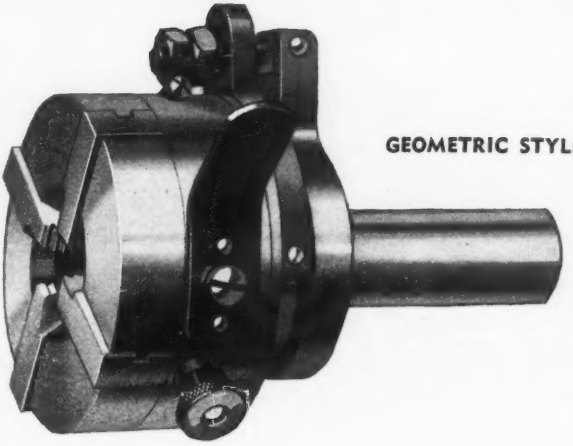
Drawing illustrating type of jig-plate which can be precision-bored on a milling machine equipped with the device described.

the horizontal movement, should the holes B, C, and D be bored first, it would be necessary to reestablish the reading before the hole A can be bored. In this case, plate "A" is shifted to the other side of plate "B" and the measurements are taken as before. The transverse screw is used to feed the work into the boring bar which is positioned in the spindle of the machine.

Unique Clock Indicates Safety Record

By G. F. Cagle

A DIAL with an indicating hand can always be depended upon to attract attention, whether the hand is there to indicate the hour or whether



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Few products are without threaded parts somewhere and fewer still are the shops where this threading cannot be done cheaper and better by Geometric Tools. Let us send you our folder describing the Style DS Head.

The Geometric Tool Company

NEW HAVEN, CONNECTICUT

This "clock", at the entrance to the Macon Shops of the Central of Georgia Railway, presents the safety record for the month.

er—as in the illustration below—it indicates the number of men who were injured at their work during the previous month.

This clock and the record-board of which it forms a part are prominently displayed at the entrance to the Macon shops of the Central of Georgia Railway. The board is mounted at the top of a smooth grass-carpeted incline upon the face of which the legend "Safety First" appears in large concrete letters.

Whenever a lost-time accident occurs, the hand on the clock is moved accordingly, the figure indicated at the end of each month being the total of such accidents for the month. This figure is then transferred to its proper square under the name of the month and the year, and the clock-hand is set back to zero, ready for another month.

Niagara Power Squaring Shears, product of Niagara Machine & Tool Works, 667 Northland Ave., Buffalo, N. Y., are fully described and illustrated in an eight-page folder now being issued by this firm. Copy free upon request.

Over the Editor's Desk

Strikes Against Strikes

BUSINESS in general has held its own throughout the United States; in fact, it should have a couple of years to go yet before the crest will have been reached. And yet the building construction and housing industries have slowed down until they are practically at a standstill. An investigation among architects and builders as to the cause of this peculiar situation brings forth one answer—costs are too high. And what is responsible for this increase in costs? The demands of labor.

Labor, like anything else, is worth what the seller can get for it. An experienced merchant prices his merchandise high enough to give him a fair profit, but low enough to invite sales. He gets all he can, but he is smart enough to keep his prices low enough to be interesting. Labor, also, is entitled to all it can get, but labor is taking the stand that it can set a price and the buyers will have to pay it. A greater mistake was never made.

Merchandisers will get along without needed store and warehouse space, manufacturers will find ways to do without manufacturing room, and the public will do without new homes rather than pay exorbitant prices—comprising practically a buyers' strike of those who would otherwise buy buildings.

What the worker fails to realize is that it is the public, and not the owner of the business, who dictates the amount of wages that shall be paid. He may force the employer to give him the increase demanded, but if the price of the product is too high, Mr. or Mrs. John Q. Public will decide to get along without it. And if people pass up buying enough, we will quickly find ourselves in the midst of another depression. Labor needs some lessons in merchandising.

Is Uncle Sam Embezzling?

IF a charitable organization took a specific fund of money and used it for purposes other than those designated when the money was raised, what would the donors think about it? If your local village or city government asked you to vote bonds to raise money for a civil improvement and then used that money for something entirely different, what would you and your neighbors think about it? Yet that is exactly what is being done by our national government, according to a statement made in the House of Representatives by the Hon. Dudley A. White of Ohio.

Mr. White says "As the social-security taxes come in, this cash is being dispersed by the Treasury for current expenditures and an equivalent amount of Government Bonds is deposited in the social-security reserve fund. For the fiscal year 1938, beginning July 1937, this source of funds alone will aggregate some $700,000,000. At the end of the year, however, apparently there will be nothing in the social-security reserve fund save that amount of government I. O. U.'s."

Withdrawals for social-security pensions have already begun, and, while the drain is not noticeable now, it will become heavier as the months and years pass. Where is the money coming from for these pensions? Is the government going to be able to make restitution in time, or are the taxpayers going to be forced to dig down and make up a deficit to cover funds that have been entrusted to the government for a definite purpose—but that are being used for current expenses?

New Shop Equipment

Norton 14-In. Multipurpose Hydraulic Universal Grinding Machine

Norton Company, Worcester, Mass., announces a completely redesigned model of their Multipurpose Grinder. This new universal grinding machine is now offered in 14 in. wing and in three lengths, 36 in., 48 in., and 72 in. The new machine is much heavier than previous models and has many advanced features which make it equally efficient for miscellaneous general production or for the tool room.

Among the features of the machine which add to its versatility and long life are: hydraulic power work table traverse, a universal wheel head and work head the latter being so arranged that either live spindle or dead center are instantly available, force feed lubrication of the table ways, and a wheel spindle of large proportions with each bearing individually and automatically lubricated.

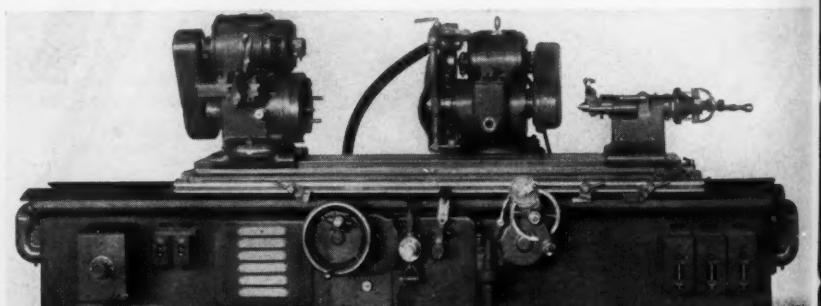
The machine is designed for direct motor drive only, a feature being that the principal mechanisms are driven each by its individual motor. Five motors are used, three of which for the hydraulic oil, lubricating oil and coolant pumps are built into the machine and are included in the regular equipment.

A flat top swivel table is used having a large tee slot its entire length. The swivel adjustment at the right end of the table comprises a screw and nut arrangement providing close adjustment. Scales are graduated to indicate taper in inches per foot, millimeters per 100 mm and degree of angle.

The universal headstock is mounted on a swivel base clamped to the table by two bolts in a manner that prevents distortion. The headstock may be turned through the entire 360 deg. and clamped in any desired position. The drive is through vee belts from an adjustable speed motor mounted on the headstock. The spindle and drive plate revolve on large ball bearings and either live spindle or dead center operation is instantly available.

Stopping and starting is controlled by a convenient lever operating a cone type clutch and friction brake so that it is not necessary to stop and start the motor. A clear hole through the spindle permits the use of a draw rod for draw-in collet, a knock-out bar, or for a water pipe for wet internal grinding.

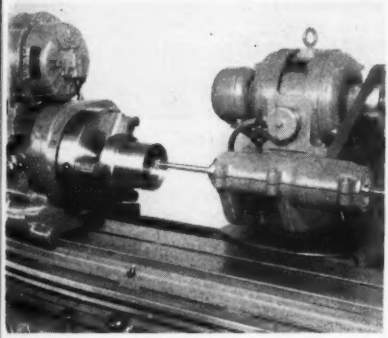
Work table traverse is either by hand wheel or hydraulic power. Hydraulic traverse is by means of a cylinder attached to the under side of the table and two pistons the rods of which are attached one to each end of the base



Norton 14-In. Multipurpose Hydraulic Universal Grinding Machine

casting. Oil is delivered from a tank in the base through a reversing valve and through the piston rods which are hollow to the cylinder. This method provides smooth and powerful table movement with the operating piston rod always in tension. When hydraulic traverse is used the hand wheel is automatically disengaged. Traverse speeds up to 144 in. per minute are available.

The universal grinding wheel head rests on a swivel base and compound slide. The wheels for either external

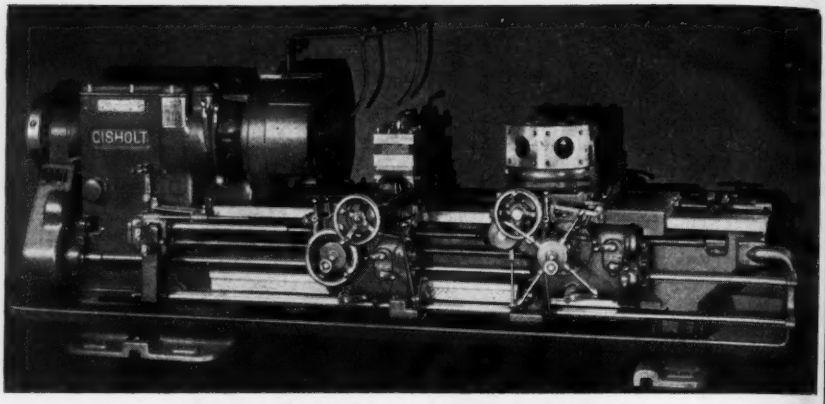


Norton Multipurpose Grinder Set Up for Internal Grinding.

or internal grinding may be set at any desired angle with the work. The external and internal grinding wheel spindles are mounted on opposite sides of the wheel head and are driven independently by a motor mounted on the wheel head and having a double shaft extension. Direct belt drive to each spindle from the motor requires no idlers nor intermediate shafts.

A hand operated grinding wheel feed indexes to 0.0001-in., and also provides for rapid movement when locating with respect to the work. The wheel feed control is conveniently located on the front of the machine and is operated from this position regardless of the setting of the wheel slide. The feed may be in the normal direction perpendicular to the table ways or in any angular direction for which the wheel head is set.

The 48-in. machine here illustrated weighs about 8000 lbs., mounts wheels up to 14x1½ in. for cylindrical grinding or cup type wheels 12x3 in. for face grinding, and will swing work 14-15/16 in. over the table top. A 5 h.p. motor is required for the wheel drive and ½ h.p. for the work drive.



Improved Gisholt No. 4L Heavy Duty Turret Lathe

Improved Gisholt Heavy Duty Turret Lathes

Gisholt 3AL, 4L and 5L Heavy Duty Turret Lathes, made by Gisholt Machine Company, 1217 E. Washington Ave., Madison, Wis., have many new features which increase production, make operation easier and faster, and improve the quality of work. The lathes are built in three sizes ranging from 6 in. to 12 in. bar capacity and 21 in. to 32 in. chucking capacity, and are identical in design, differing only in size and capacity. They are intended for both large quantity production of similar pieces or small lot jobbing of irregular and varied types of work. The machines are available with complete attachments, standard tools, chucks, boring bars, reamers and special tools and holding devices ready to go into production.

In the construction, the bed and headstock of these machines is cast in one piece from nickel semi-steel, this bed casting weighing nearly half the total weight of the finished machine. The bed ways are of steel, hardened and ground in place which provides a bearing that has proven to be most satisfactory in eliminating wear and in preserving the original accuracy of the machine.

The new 12 speed transmission is of the sliding gear construction and has a normal speed range of 12 r.p.m to 220 r.p.m for the 3AL and 8 to 142 r.p.m. on the 4L and 5L. Speeds are arranged in geometric progression for the varying diameters of work. The spindle is mounted on twin tapered roller bearings at the front and a straight roller bearing at the rear. An automatic multiple disc spindle brake stops the spindle quickly when the clutch lever is placed in neutral position. All gear shafts and bearings run in an oil bath and the spindle bearings are continually fed with clean oil from a catch reservoir. Perfect lubrication is assured with a minimum of attention.

Feeds and rapid traverse are controlled at each carriage entirely independent of each other. The eight reversible feeds are selected at the aprons and range in arithmetical progression from 0.008 to 0.250 in. With the change gears provided, this range may be varied from a fine range of 0.004 to 0.125 in. to a coarse range of 0.016 to 0.500 in. providing a total of 64 available feeds. Feeding is accomplished through separate accurately cut lead screws for each carriage and the feeds provided permit the cutting of all U. S. standard threads from 2 to 32 including 11½. Special change gears may be provided for special threads.

Power rapid traverse is provided for the longitudinal movement of both carriages. The rapid traverse is independent for each carriage and may be used without disengaging the feed. An electrically operated power rapid traverse may be supplied for the cross slide or the compound slide which, on some types of work, greatly assists the operator and materially increases the day's production. Multiple vee belt motor drive is standard with the motor mounted on the headstock, the motor being 15 to 25 h. p. for the 3AL and 25 to 40 h. p. for the 4L and 5L, depending upon the speed of operation or the type of work.

The broad turret mounting affords ex-

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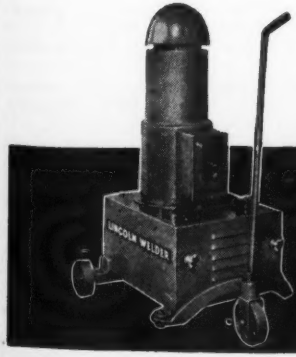
Lincoln's large quantity production brings you this welder at the lowest price set for this type of welding equipment. Easy terms can be arranged. Mail the coupon for details.



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ceptionally rigid support to the hexagon turret, which is clamped by closing a double bevel clamp ring actuated by a powerful eccentric toggle. Each face of the turret is located by a tapered pin which seats in tapered index bushrings. All parts of the locking and locating mechanism subject to wear are made of hardened steel to insure accuracy.

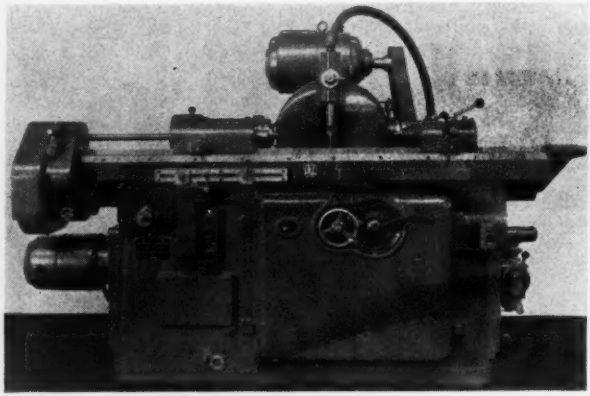
Machines are available with either fixed center hexagon turrets or cross feeding turrets. The fixed center turret is usually furnished for work produced in comparatively large quantities where multiple tooling, piloted supports and, in many cases, special tools are used. Cross feeding turrets are used for work involving small lots of a wide variety of shapes and sizes as well as many classes of large production work. The cross feeding turret permits of facing as well as turning and boring cuts with the hexagon turret.

Thorough lubrication is insured to all important bearings by effective automatic methods. The headstock runs in an oil bath as do the gears in each apron. The rapid traverse clutches and gears also run in a continuous oil bath. The hardened steel ways are lubricated by means of force feed pumps attached to each carriage. Each movement of the rapid traverse lever delivers oil under pressure to each way under the carriages.

Extra attachments are available that admirably adapt these machines to individual manufacturers' requirements. These include a compound slide carrying the square turret; bar feed; either power or hand operated; collet chucks for 3ALs; turret centers for heavy work where outer support is required; selective gear box in place of pick off gears for varying the speed of the speed shaft; taper attachments for both the cross slide carriage or the hexagon turret carriage. Gisholt 3 jaw scroll chucks; 4 jaw independent chucks; 4 jaw combination chucks and hydraulic chucks; and an extensive line of standard tool equipment for chucking work and bar work.

J and L Automatic Thread Grinding Machine

The Jones & Lampson Machine Company, Springfield, Vt., announces an automatic thread grinding machine designed to grind threads on work up to 8 in. in diameter when using a 20-in. grinding wheel. Work 40 in. long is accommodated between centers and 18 in. of thread may be ground anywhere on



J & L Automatic Thread Grinding Machine

36 in. of work length. The swing over the work slide is 11½ in., and 11½ in. diameter threads may be ground when the wheel is 16½-in. diameter or smaller. A 20-in. wheel is furnished as standard and, as wheel decreases in size, proper peripheral speed may be retained through rheostat control of the wheel motor.

The helix angle capacity of the machine has been increased to include 25 deg. right hand and 30 deg. left hand.

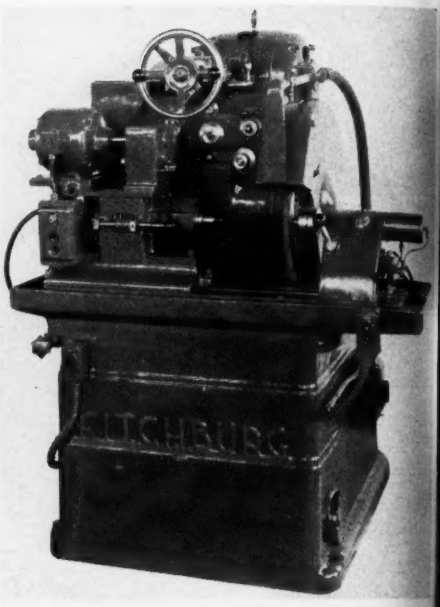
The helix angle is controlled by means of a worm and gear.

The machine will grind single, double, triple, quadruple and sextuple threads, either right or left hand. Standard equipment includes change gears for pitches from 2 to 48 inclusive. Using a simple hardened and ground former, taper, combination of straight and taper or double taper threads may be ground. No adjustment of thread form required when changing from straight to taper threads, and the J. & L. method of grinding taper threads makes lead compensations unnecessary.

With the necessary attachments, the machine will grind button-type hobs and circular chasers without lead. It will back off or relieve straight or taper hobs

or taps with either straight or spiral flutes.

A direct current motor is recommended for driving the wheel, provision being made for running all types of grinding wheels at the most efficient work speeds. An indicator shows the number of surface feet the wheel is running, based on wheel diameter and r. p. m., and a graduated rheostat with pointer indicates the r. p. m. As the wheel is reduced in diameter, the speed is maintained by simply turning the dial on the rheostat. Either A. C. or D. C. motors can be furnished for the wheel trueing device, coolant pump and for operating the machine. The self-trueing, self-sizing mechanism of the machine brings thread grinding into the range of practical shop operations. It is suited equally well to tool room and production work.



Fitchburg Plain 6x12-In. Cylindrical Grinder

Fitchburg Plain 6x12-In. Cylindrical Grinder

The illustration shows a 6x12-in. Cylindrical Grinder which has been placed on the market by Fitchburg Grinding Machine Corporation, Fitchburg, Mass. The machine was designed to do plunge-cut grinding only. The table is stationary, the wheel reciprocating.

The machine is built around a Fitchburg standard "Bowgage" Wheel Head Unit, which has a completely automatic cycle and dial controlled from the panel. Headstocks can be furnished for either live or dead spindle operation, and the complete cycle can be interlocked so as to operate from one lever. It can also be equipped was a retractable headstock center and solid footstock, which has some advantages for certain classes of work.

The grinding wheel is carried on the right hand side of the spindle instead of the conventional left side; thus the wheel spindle space is consolidated with the headstock longitudinally, saving floor space, yet the machine has the weight and wheel diameter to handle comparatively large work.

The machine is also built in a chucking grinder model. The work head can be swiveled to a suitable angle for taper

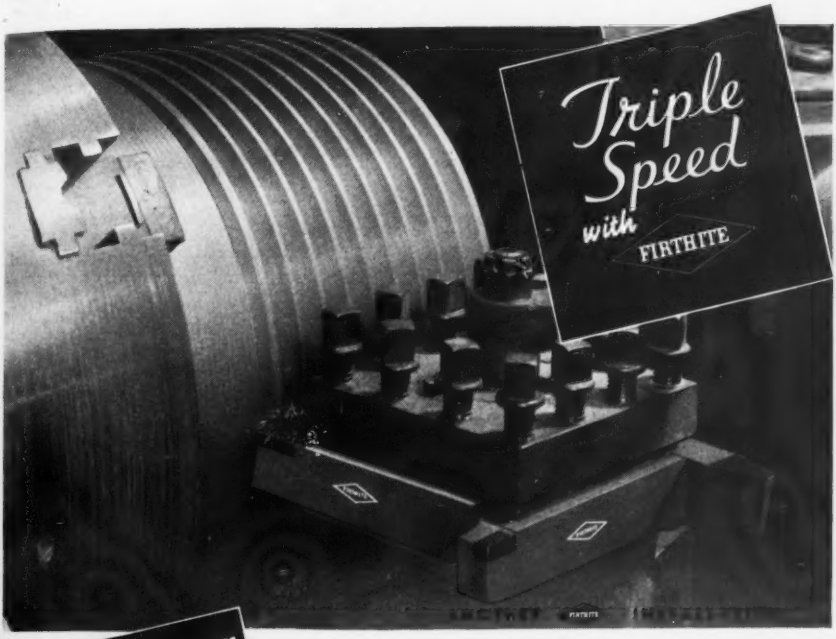
work. Truing devices may be furnished for semi-automatic operation; either hand truing or the wheel hood mounted type may be used, depending upon the work to be done.

The maximum length between centers is 12 in., and the maximum swing over the table is 14 in. Height from floor to centers, 42 in. Number of work speeds, infinite from 50 to 350 r.p.m. Diameter of grinding wheel spindle, 3 in. Maximum feed of wheelhead on diameter, 0.125 in. Rapid traverse may be set at from 0 to 5 in. Range of grinding feed rates, infinite. Wheel sizes available, 24x2x12 in. Maximum width 20x4x12 in. Spindle drive motor for 2-in. face wheel, 5 h.p., 1500-1800 r.p.m. Headstock motor, ½ to ¼ h. p., 1500-1800 r.p.m. Floor space required, 36x4[illegible] in. Weight, net, 4800 pounds.

I.M.C. Lester Designed Injection Molding Machine Type LPM-2

Announcement is made of a new Injection Molding Machine by the Index Machinery Corporation of Cincinnati, Ohio who are sole distributors for it in the United States and Canada. Fully automatic and ruggedly constructed, this new I. M. C. Lester-Designed Injection Molding Machine meets the requirements for the injection of larger articles with a maximum weight of 6 ounces per casting.

The machine operates either automatically or semi-automatically. For the semi-automatic operation of the machine, a single operating lever is provided; this lever is conveniently located to insure operating efficiency. The full-automatic operations of the machin[illegible]



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Four FIRTHITE tipped turning and grooving tools are roughing and finishing a 14-inch diameter semi-steel sheave at a cutting speed of *150 feet* per minute. The maximum cutting speed with high speed steel tools previously used was *50 feet* per minute.

From every angle and on almost any machining application FIRTHITE tools make real savings, because of this ability to cut materials at higher speeds without deformation, or loss of hardness.

The smoother more accurate finish, longer tool life and reduction in machining time result in savings that deserve the attention of production executives.

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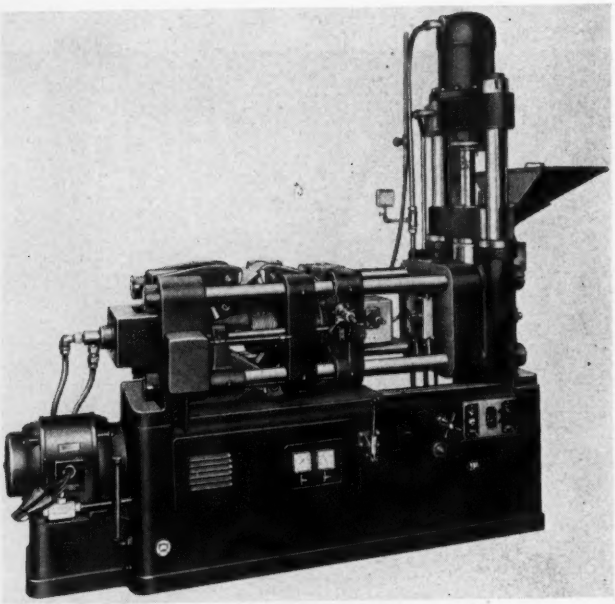

I. M. C. Lester-Designed Injection Molding Machine LPM-2

are controlled by two electric clocks; all controls are arranged within easy reach of the operator and a change of position is unnecessary for complete control of the machine.

The molds are closed by hydraulic power, operating toggle joints, and these joints are firmly locked by tapered surfaces when the mold is closed, which action removes all strain from the toggle pins and insures rigid locking of the molds during injection. As a result of this construction this machine is capable of holding the molds closed for the injection of an area of 40 square inches.

Another new feature of this equipment is the adjustment of the mold on the tie bars. This is accomplished thru the use of a worm and worm wheel by which the die plates are advanced uniformly, thereby insuring absolute parallelism of the die plates on the tie bars at all times. The tie bars are 3¼ in. in diameter.

The entire heating cylinder is chromium plated and is ingeniously constructed in that all adjustments can be readily made in view of the fact that the entire heating cylinder assembly swings away from the machine, affording exceptionally easy accessibility for adjutments. The injection stroke of 8½ in. is accomplished in 3 seconds. The base of the machine serves as an oil reservoir.

This machine is a completely self-contained unit, ready for operation as soon as the 10 h.p. motor is installed, and no other auxiliary equipment is required.

Bulletin containing complete specifications is available by addressing Index Machinery Corporation as above.

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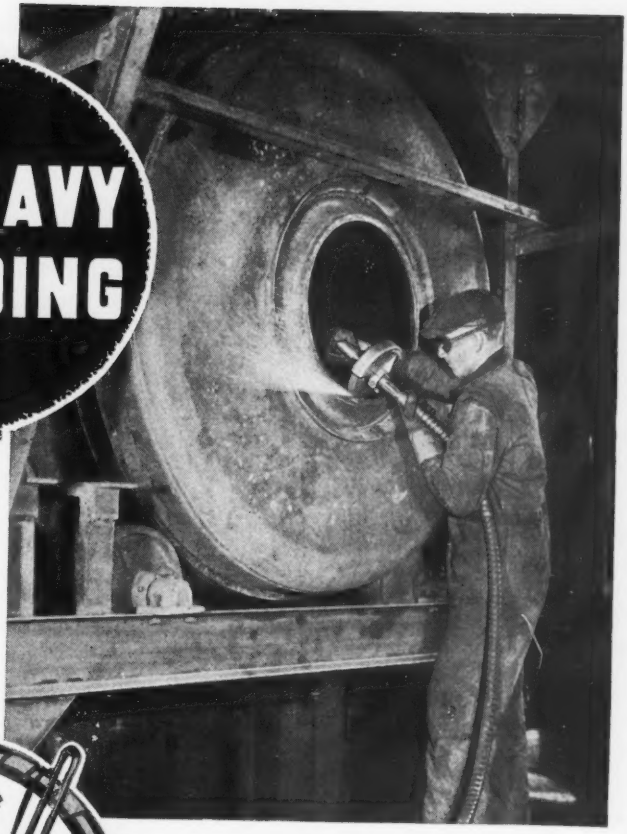

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On heavy construction work — where power, speed and portability are factors—you'll find new economy, new plant efficiency and increased production capacity with HASKINS.

A 40-page catalog is available to executives.

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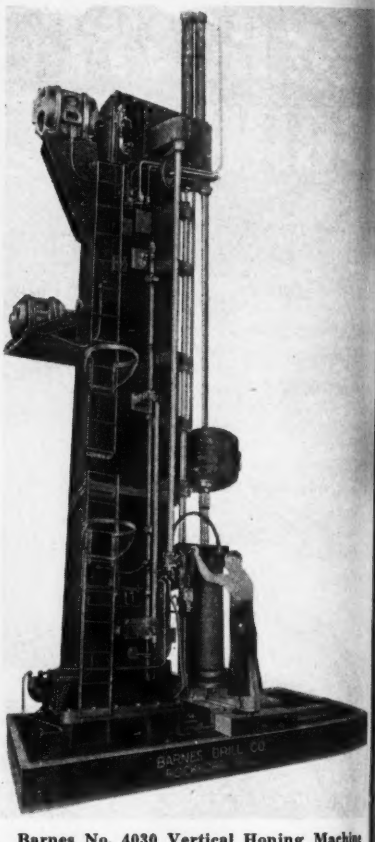
FLEXIBLE SHAFT EQUIPMENT
with Greater Adaptability

Barnes No. 4030 Vertical Honing Machine

What is probably the largest vertical honing machine ever designed has been brought out by Barnes Drill Co., Rockford, Ill. The machine is designed to



Barnes No. 4030 Vertical Honing Machine

handle hones up to 30-in. diameter and as shown in the photograph has 90 in. of vertical spindle travel. The job illustrated is that of honing a Diesel engine sleeve having 17½-in. diameter bore by 5-ft. length. The operation is said to be smooth and uniform, with no shock at either end of the stroke. The head reciprocates on ball bearings, running on flat tracks in the hardened vertical bars.

The large aluminum reciprocating head which carries the big bronze driv-

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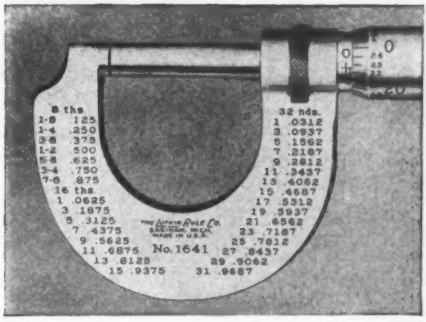

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ing gear together with the spindle and hydraulic pistons are supported on the air counterbalance shown with the vertical rods at the top of the machine. No air is wasted, as on the down stroke the limited amount of air in the cylinder is pushed back into the main line.

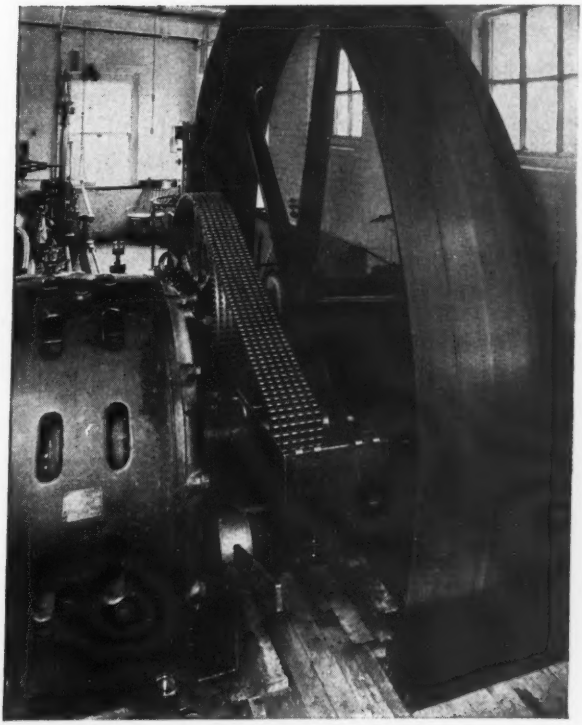
The eight speed changes are controlled from lever at the operator's position. There are three levers, one controlling the back gears and the other two each shifting two speeds as on the standard transmissions, the shifter forks being operated by means of chain drives from the telescopic tubing and shaft inside thereof. The upper motor in this case is 30 h.p. for 17½ to 21-in. diameter cylinders, but a larger motor will be used for larger work. The lower motor is 15 h.p. for driving the Vickers hydraulic pump system. A small motor at the bottom of the column provides a generous flow of coolant. Reservoirs in the base have more than 100 gal. capacity.

Height of the regular machine to extreme top with spindle up, 31 ft. 4 in. Distance, center of spindle to face of column, 20 in. Maximum distance from top of table to nose of flange spindle, 204 in. Floor space required, 172x86 in. Size of oil-operated work table, working surface, 40x60 in. Horizontal travel of oil-operated table, in and out on tracks, 50 in. Spindle speeds provided, 12, 16, 22, 30, 39, 54, 72 and 98 r.p.m. Net weight with hydraulic pump, motors, starters and filter, 34,700 pounds.

Newton Unit Head Box Type Milling Machine

A new line of milling machines which permit converting single purpose machines into machines for future work has recently been developed by the Newton Division of Consolidated Machine Tool Corporation, Rochester, N. Y. This type has been designated by the makers as a unit Head Box Type Milling Machine, and that the naming is correct can be readily noted from the photograph of a typical machine in this line.

As can be seen, the machine is actually made up of several individual milling units on a planer type milling machine base. The machine illustrated is of extreme rigidity. It has two horizontal head units, two vertical units plus an auxiliary vertical spindle for cleaning out the cut between two large vertical cutters. Later on should this machine



(Photo courtesy Swansea Print Works. Illustration shows upper half oil-proof casing removed.)

More KILOWATTS with ROLLER CHAIN

The Baldwin-Duckworth Chain drive shown here hooks a steam engine with a generator and gives a speed *increase* of 7.05 to 1. This is an unusual drive problem, but typical of the many successful ways in which roller chain may be used.

Chain speed is 1310 F.P.M. and the drive transmits up to 200 H.P.

Baldwin-Duckworth precision machining and selective heat treatment produce a roller chain that will efficiently and economically handle any power transmission or elevating problem.

Send for catalog. Baldwin-Duckworth Chain Corporation, Springfield, Mass.

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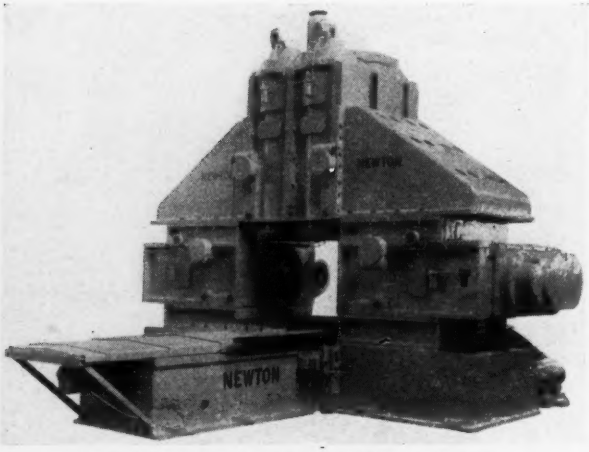

Newton Unit Head Box Type Milling Machine

be required for work necessitating, say four horizontal spindles, the machine can be easily arranged for this operation by transposing the independently-driven vertical heads and substituting a fill-in piece at the top to complete the girt.

This is not the only change possible, however, as the unit heads can be reset for use in any position—horizontal, vertical, or at any angle. The box type construction also permits rearrangement of blocks and unit heads to accomplish the particular milling job necessary.

This development has increased the usefulness of milling machines built for specific jobs because it means that machines do not have to be discarded as product or design changes eliminate the need of that particular operation. With this new unit head box type construction, as the job changes all that is necessary is to rearrange heads and blocks and set them in position in accordance with new work to be performed.

The machine illustrated is arranged

Winners

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THE JACOBS MANUFACTURING COMPANY

HARTFORD CONNECTICUT, U. S. A.

to mill top, bottom, sides and ends of tractor transmission cases in two operations.

Spindle heads are individual units, each head having its own motor mounted directly on the head and direct gear connected by silent pinion through suitable reduction gears including pick-off gears which can be transposed or changed for varying cutting speeds. Machines can be furnished with quick change gears and also with D.C. adjustable speed motor drive. Each spindle has separate end adjustment and provision for locking spindle quills. In addition all heads can be repositioned along the holding flanges as they are drilled with closely spaced bolt holes to allow for setting up in small increments closer or farther away from work. Wide faced flame hardened herringbone spindle gears are used.

Table is of planer type construction with self-aligning V-shaped ways. It has planed top surface and is provided with parallel T-slots. Pressure lubrication is provided and oil filter is also furnished.

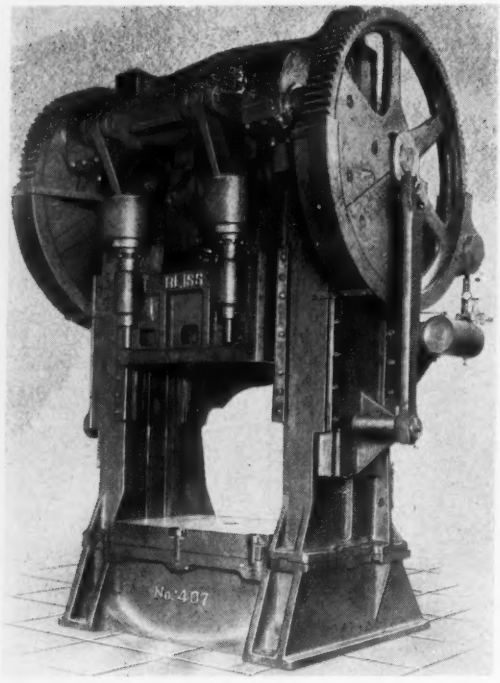
Feed drive to table is by hydraulic pressure and is controlled by single lever at operating position. This hand control of feed and rapid traverse is supplementary to automatic control regulated by adjustable trip dogs on side of table. Machines may be provided with hydraulic screw or cylinder feed or mechanical screw feed.

Lubrication of each head is independent, filtered oil being supplied under pressure and the operation readily checked by visible oil flow gauges.

A feature that adds to convenience and ease of operation is the device for handling the changing of the heavy cutters used. This consists of a jointed arm attached to rear of machine which can be swung into position for attaching or removing cutters.

"Bliss" No. 407 Toggle Drawing Press

While it is true that the single-action press with built-in drawing cushions to do double action work has become increasingly popular, there is a very definite limit to the range of work which can be accomplished with this type of equipment. In other words, the use of high blank-holding pressures, particularly with deep draws, involves a decided increase in the capacity of the



Bliss No. 407 Toggle Drawing Press

driving train on the press, including motor and flywheel.

The toggle double-action press, illustrated herewith, has advantages in positive gripping for stretching jobs with draw beads and in power economy on deep draws. It can draw a shell 10 inches in depth, giving maximum efficiency in the process. Then it also can be converted from a double-action into a triple-action press by the addition of Marquette drawing cushions in the bed.

The Bliss No. 407 double-crank, double-action, straight-sided, toggle drawing press illustrated is a long-stroke model. Its frame is made of four separate castings held together by extra-heavy steel tie-rods which are shrunk in. A 35 h.p. electric motor drives the flywheel through V-belts, which in turn drive the double-geared twin-drive train of gears.

The control is completely electric, with push buttons to start, stop or inch the press. The ability to inch is an invaluable asset in die setting. The clutch is a new Bliss full automatic, air-operated, combined friction clutch and brake with the clutch mounted in the flywheel. The flywheel is mounted on Timken roller bearings.

Some of the more important dimensions are as follows: diameter of crankshaft at bearings, 7 in.; at pins, 8 in.; plunger stroke, 21 in.; blank-holder stroke, 14 in.; shut height bed to blank-holder, stroke down adjustment up, 3¼ in.; bolster, 6 in. thick.

The crankshaft and the intermediate shaft have renewable bronze bushings while the driveshaft is mounted on renewable Timken roller bearings. The bed is completely arranged for the addition of air cushions should it become necessary. The feature saves a great deal of time and money in installing cushions.

Sundstrand Tool Grinder

For the accurate, fast, and economical grinding of cemented carbides and other cutting tools, the Sundstrand Machine Tool Co., 2529 Eleventh St., Rockford, Ill., has brought out the tool grinder illustrated herewith. The Sundstrand Tool Grinder is intended to meet modern requirements by providing means for establishing accurate angles quickly, for producing smooth, keen cutting edges, for free cutting, clean grinding, and for sensitive control of the operation. The machine is rigid, compact, and powerful.

Sundstrand Tool Grinder

The machine is constructed on a heavy box section pedestal with large base which provides rigid support for wheel spindles and work tables at a convenient height. Motor drive is completely enclosed. Two independent heavy spindles of heat treated chrome nickel steel are mounted on the same center line and run in precision anti-friction bearings protected by special oil seals. V-belts provide a smooth flow of power from the motor to the spindles and dampen vibration. The motor is started, stopped and reversed through a conveniently located switch. The reversing feature enables the operator to do all grinding with the wheel running toward the

We have a large and diversified line of standard burs carried in stock for quick delivery. Often your finishing problem can be solved easily with one of these. If not we can develop special burs for your job. Send for your copy of our catalog showing over 300 standard burs. It is free to any interested executive. Write to Pratt & Whitney, Division Niles-Bement-Pond Co., Hartford, Conn.

Executives often fail to realize the many jobs these small, inexpensive, handy tools will do. A bur (or rotary file) can be shaped to do a particular job and reach that difficult place. Often a bur driven by a flexible shaft will do work that otherwise would be impossible or highly expensive. Burs do a better job than hand files, with a fraction of the effort.

Keller Burs are well made. Rigid specifications control their material, manufacture and heat treatment, so that each bur conforms to the high standards established. Every bur is particularly suited for the job it must do.

KELLER BURS

cutting edge of either right hand or left hand tools, thus increasing smoothness and durability of the edges.

A grain wheel is provided for rough grinding and a diamond-faced wheel for finishing. The rough grinding wheel has a steel back and is mounted on a spindle pilot. The steel guard is adjustable to provide for 2¾-in. wheel wear. A three-way valve and double nozzle floods either side of the grinding wheel with coolant as required. The rough grinding table has trunnions in well protected bearings to allow adjustment from 10 deg. above horizontal to 30 deg. below. The position of the table is indicated clearly on a direct reading scale and the table is clamped solidly by one simple movement. The carriage supporting the rough grinding table forms a catch basin for coolant and abrasive; it is mounted for oscillation and infeed on a heavy steel bar solidly secured in the machine column. Grinding is accomplished by oscillating the carriage, table and tool as a unit. Conveniently placed handles at opposite ends of the rough grinding carriage enable the operator to sweep tools completely across the face of the cup-shaped grinding wheel. A capstan nut and accurate screw feed provide delicate control of grinding pressure and the amount of metal removed. A quick-acting clamp on the underside locks the rough grinding carriage in horizontal position for top rake grinding.

The diamond-faced finishing wheel is mounted on a spindle pilot fully protected by a steel guard that is adjustable for right hand or left hand grinding. The finishing table is hardened and ground. A conveniently located clamp locks the table securely in any position from 10 deg. above horizontal to 30 deg. below horizontal. The carriage supports the finishing table in well protected trunnion bearings and forms a catch basin for coolant. It is mounted on a

INCREASED SEEING EFFICIENCY AT LESS COST!

You can grind out profits with the "better than daylight" illumination of the new horizontal Cooper Hewitts. There is no glare from polished metal surfaces . . . scratches are easily detected . . . eyes are rested . . . and better work is more easily accomplished.

By adding incandescent lamps to the mercury within the fixture, lighting is obtained that closely resembles daylight values for operations that require perception of color.

The detail-revealing light of mercury vapor is now produced at 22% less cost. And, the new unit hangs horizontally to give the best distribution of the soft, non-fatiguing light which its long lamp provides. Starting is instantaneous. Power factor is high.

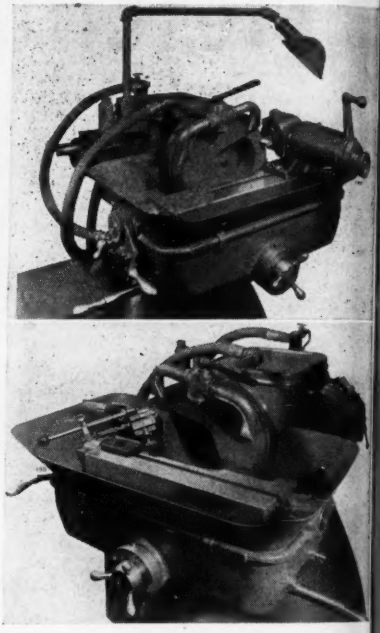
Get full details about these improved units. They are made in two sizes: 50 inches long operating at 350-watts; 33 inches long using 275-watts. Bulletin 827DM illustrates their many advantages for you. Write for a copy. General Electric Vapor Lamp Company, 897 Adams Street, Hoboken, New Jersey.

GENERAL ELECTRIC VAPOR LAMP COMPANY

8297

heavy steel shaft rigidly supported in the machine column. An adjustable lamp bracket and reflector provide means for focusing ample illumination upon tools.

The machine is available in two models: Model A, with rough grinding wheel operating at 950 r.p.m. and finishing wheel at 3600 r.p.m., and Model B with rough grinding wheel running at 2100 r.p.m. and finishing wheel at 3600 r.p.m.



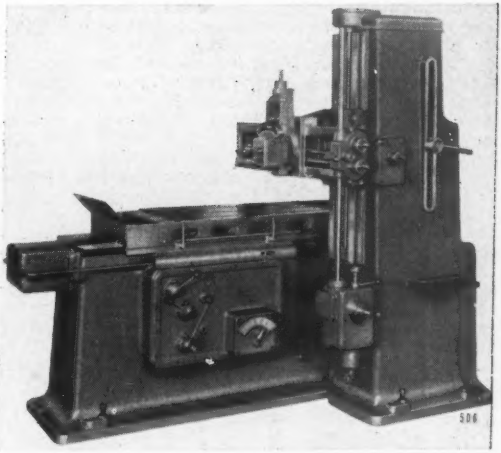
(Above) Top rake fixture. With the fixture set up as shown and a tool clamped in position, the operator turns the feed screw until the tool touches the grinding wheel. He then oscillates the lever, sweeping the tool across the face of the wheel. (Below) Drill sharpening fixture. This fixture will sharpen twist drills and countersinks up to ½-in. diameter.

The height of the spindle above the floor is 40¼ in. and the dimensions of the base are 25x26½ in. Floor space required, 41x37 in. Weight, including motor, 1090 pounds.

Extra equipment includes a 1½ h.p. 1800 r.p.m. or 1500 r.p.m. motor, 10-in. diameter grain wheel for roughing, 6-in. diameter diamond-faced wheel for finishing, top rake fixture, clearance angle fixture, finishing protractor, drill sharpening fixture, diamond wheel dresser and holder.

Rockford 36-In. Hy-Draulic Openside Shaper

To make possible the surface machining of small work which would not be economical for a large planer and which is still too long for accurate machining on the ram-type shaper, the Rockford Machine Tool Co., Rockford, Ill., has brought out the 36-In. Hy-Draulic Openside Shaper illustrated herewith. This machine reciprocates the work instead of the tool and provides a double-length bed and planer-type table upon which the work-piece can be supported solidly at all points in its travel. The cutting tool head is carried on an easily adjusted heavy rail which has a rigid brace extending to the rear of the massive column. This construction is intended to retain the speed and convenience of the shaper, provide the accuracy and easy set-up of the planer, eliminating overhang, reduce wear, and insure accurate work.



Rockford 36-In. Hydraulic Openside Shaper

In addition to the advantages noted, the 36-In. Hy-Draulic Openside Shaper also provides the advantage of hydraulic drive. The hydraulic drive is direct and highly efficient. No power is wasted in driving complicated or unbalanced mechanisms. Cutting speeds and pressures

are constant throughout the entire cutting stroke and the tools can be worked at maximum efficiency. Any desired stroke length and position relative to the work is available instantly without stopping the ram or using tools. The same ease and complete range of adjustment applies to the hydraulic cross feeds to the table. The reverse is quick yet shockless. Stroke length can easily be altered to follow the contour of irregular work and the tool can be stopped anywhere in the cut, inched or reversed.

Full cutting pressure is always available with complete safety for the machine, tool and work. Operating the stop lever locks the hydraulic circuit and halts the machine instantly without shock or coasting. The machine has very few fast-moving parts and these are submerged in oil or pressure lubricated.

The heavy box section bed is double the stroke length and contains a large reservoir for hydraulic oil. The hydraulic cylinders are fully enclosed. Three ranges of cutting speeds are provided, each having infinite adjustment between the maximum and minimum. Quick-clamping dogs provide accurate adjustment of stroke length without stopping the machine or using tools.

The heavy rail has integral triangular box section brace and is securely anchored to the column on widely separated ways. The head is heavy, accurately mounted and gibbed to the rail, and has micrometer adjustment for the tool slide. A similar head for side mounting is available. Centralized controls provide easy engagement of power transverse feed of the rail head in either direction, of tool slide up or down, and manual adjustment of both. A massive box section column, designed in the modern manner, is accurately and securely anchored to the bed. Hydraulic controls are centralized on a neat, self-contained panel.

The minimum stroke is 1 in., nominal stroke, 36 in., and actual stroke, 38½ in. Vertical travel of tool, 9 in.; horizontal travel, 30 in. Vertical adjustment of cross rail, 24 in. Maximum distance, table to cross rail, 24 in. Length of table, 58 in.; width of table, 21½ in. Working surface of table, 21½x36 in. Length of bed support for table, 74 in.

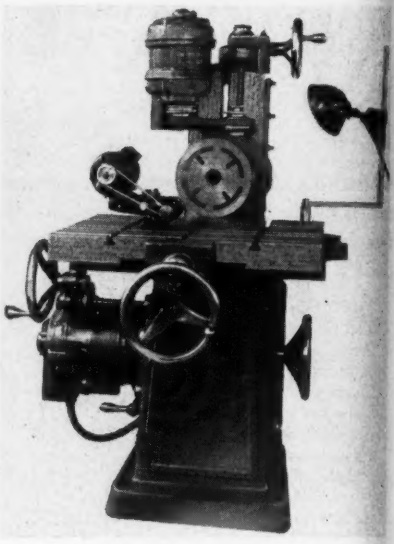
Table speed changes, infinite. Number of feeds, infinite. Range of vertical and horizontal feeds, 0 to 0.100 in. Height, 6 ft. 10 in. Floor space required, including motor, 4 ft. by 9 ft. 4 in.

Approximate weight crated for domestic shipment, 9000 pounds.

Hack Universal Die-Making Machine

Need for a single machine to meet the varied requirements of the die making industry has been met by Mr. Frank W. Hack, a Chicago manufacturer, in his development of a universal machine that stands alone in its field.

Faced in his own plant at 440 North



Hack Universal Die-Making Machine

Oakley Boulevard, Chicago, with the ever present problem of time wasted in shifting from machine to machine with the attendant delay of locating parts, Mr. Hack conceived the idea of economizing time and labor by combining the major operations in one machine.

This multiple use machine, occupying only four feet square of floor space, was designed and built to do all the mechanical and most of the hand operations which until now have required the use of separate machines and expert artisans.

The requirements which have been met in the actual performance of this machine include two distinct ranges of cutting properties, heavy and sensitive duty and the inclusion in one machine

of reciprocating as well as rotary motion, together with the performance of a maximum number of operations with a minimum of attachments, each easy of adjustment and so designed that lifting of heavy parts is unnecessary.

Stripped of all removable units the machine consists of a base, a spacious compound table, a reciprocating rear ram, adjustable for stroke of position and lockable in a stationary position if desired. To this ram is fitted a master head to which other attachments are fastened, and incorporated in this head is a back-geared milling spindle vertically adjustable within the ram, thus embracing all the functions of a horizontal milling machine. The head also serves as a lathe spindle, increasing the adaptability of the machine.

Multiple uses are made possible by the vertical head, which is simply and easily attachable. Rotatable throughout a circle, it affords eight speeds; four back geared and four high speed, and there are four speeds in the angular position, all back geared. In connection with this spindle, but removable from it, is the sensitive slotting head, used also for filing and lapping and other reciprocating operations, which can function at any angle.

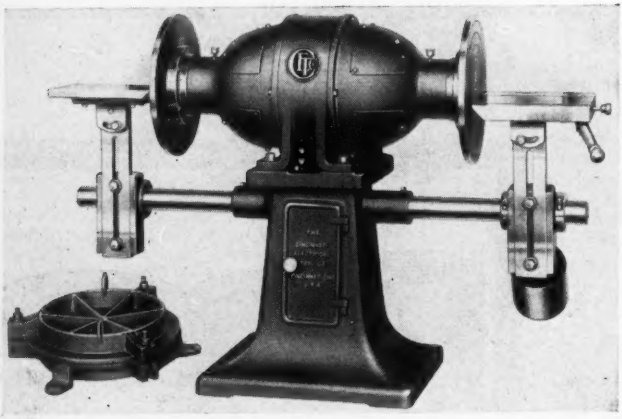
A hack saw frame instantly attachable to the master head and using standard blades can be used interchangeably with an elevated table or with the centre plate in the table top. Electrical equipment consists of a three h.p., 60 cycle, 220 meter 3 phase motor which drives the ram and a ¾ h.p. unit for the master head.

Fifteen different kinds of cutting operations are done with the regular equipment and this number can be doubled with auxiliary adapters.

"Cincinnati" Disc Grinders

The Cincinnati Electrical Tool Co., a division of The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, has announced the addition of several sizes of disc grinders to their general line of such equipment. The grinders may be had in the double end disc type as shown in the illustration, or with a disc on one side and a conventional type grinding wheel and wheel guard on the other side.

The discs are of high grade steel accurately machined and balanced to ensure running true. The spindle is of nickel steel dynamically balanced and mounted



Cincinnati Disc Grinder

on extra large ball bearings with special provision for both radial as well as thrust loads.

On the double disc grinder a table with hand lever feed is regularly supplied on the right-hand side of the machine with a plain table on the opposite side but this equipment may be changed to suit individual requirements. On the combination type unit a table with hand lever feed is regularly furnished on the right-hand side, with a fully enclosed safety wheel guard for the grinding wheel on the other.

The steel discs furnished as standard equipment may be had for either glueing on abrasive discs or properly drilled for mounting steel-back abrasive discs. A disc press can be supplied for glueing abrasive discs to steel discs.

The motor supplied is of the fully enclosed type with magnetic starter with both overload and no voltage protection and push button control.

Eliminates Friction
IN PARTS HANDLING AND STORAGE

● Manufacturers of anti-friction ball and roller bearings that are world famous for their maintenance and lubrication economies . . . SKF Industries, Inc., depends on Lyon Steel Shelving for the economical storage and smooth flow of hundreds of types and sizes of bearings from production line to users.

Another example of the versatility and practical economy of Lyon Steel Shelving. Because it combines maximum utility, flexibility and salvage-ability, Lyon Steel Shelving is a lasting asset. It permits quick, low-cost rearrangements and additions at any time . . . is not affected by dampness . . . resists fire . . . will not warp, swell, shrink or split. Mail coupon for full details.

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AURORA, ILLINOIS

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STORAGE EQUIPMENT *Service*
LYON METAL PRODUCTS, INCORPORATED Aurora, Ill.

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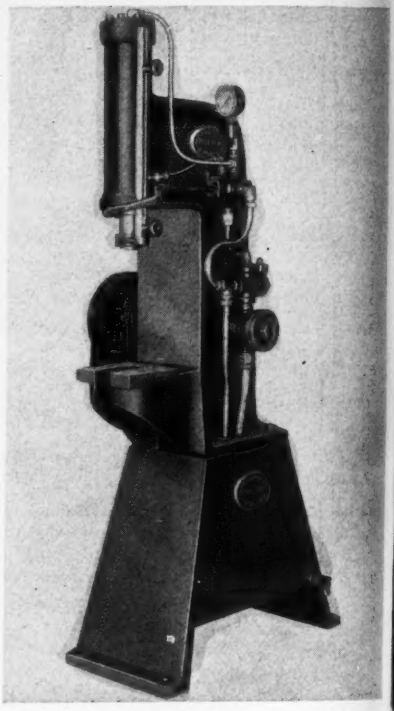
Please send information as checked:
☐ Bulletin on Steel Shelving; ☐ Tool Cribs; ☐ Shop Boxes; ☐ Lockers.

Name .....
Address .....
City ..... State .....

Greenerd Two and Four-Ton Hydraulic Presses

A hydraulic press in both two and four-ton sizes is now being made by Greenerd Arbor Press Co., Nashua, N. H. The frames of the two sizes are identical, the difference being in the pump and motor equipment. The frame is cast of special hydraulic semi-steel and the

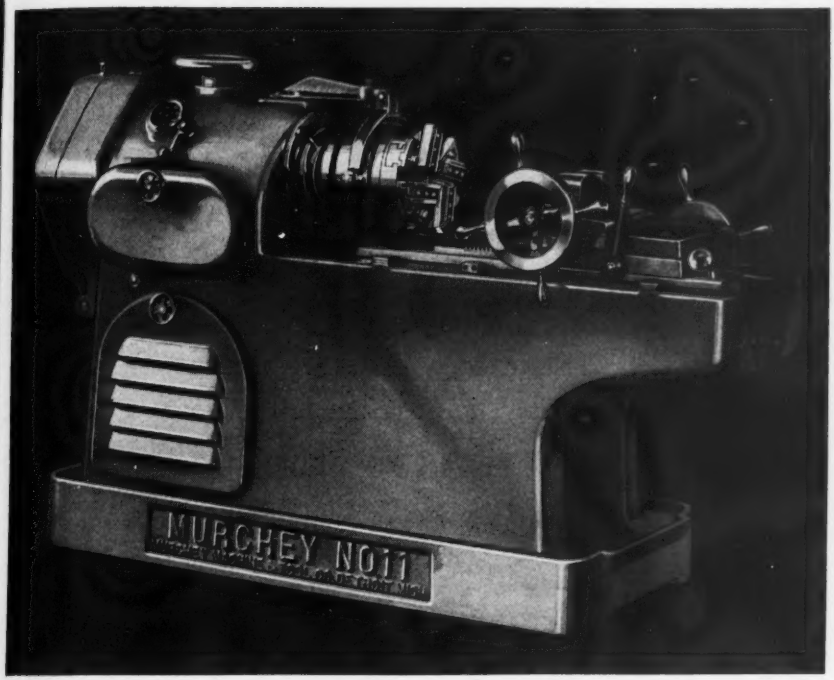


Greenerd Hydraulic Press

press is equipped with a 3½-in steel piston with three cast iron rings. Rams are of alloy steel and are packed with chevron type packing. The glands are equipped with a bleeder pipe to take care of any surplus seepage.

The motor and hydraulic pump are mounted on opposite sides of the main housing and the pump is connected between a 16-gal. sump in the base and a pair of hydraulic valves mounted on the side of the frame.

Power is applied by means of a hand lever, and pressure will remain on the



MORE and BETTER THREADS

You can get *more* and *better* threads with this new threading machine—the latest in design and modern improvements.

You can learn about this "profit-maker" from the new Murchey catalog which diagrams and explains the No. 11 and No. 22 machines. The catalog shows various views of the tangential chaser die head, a sectional view of the whole machine and details of the heavy forged steel spindle with integral flange.

It will pay you to investigate this machine.

Write today for catalog.

MURCHEY MACHINE & TOOL CO.

DETROIT • • • MICHIGAN

work until the lever is released, this movement automatically returning the ram up to a power stop which may be set at any predetermined point. The press has an adjustable stroke from 1 to 16 in. and the ram is 2 in. in diameter. Pressure may be set at any point between ½ ton and full capacity of the press.

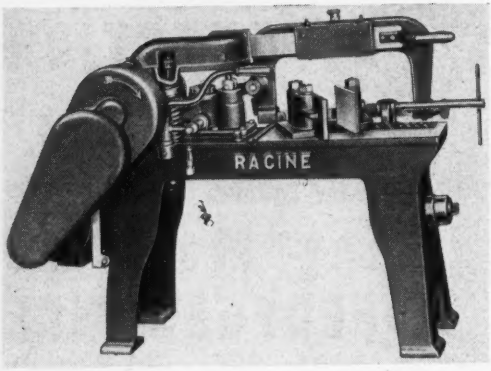
When the press is equipped for two tons pressure, equipment may be supplied to give a ram speed of 276, 224 or 150 in. per minute on the down stroke under full pressure as preferred. The return stroke would be 480, 330 or 216 in. per minute. When equipped for four tons pressure, equipment may be furnished to provide a ram speed of 132 per 200 in. per minute on the down stroke for which the return stroke would be 216, 330 or 558 in. per minute.

The working surface of the table is 8x8 in. with a 2¾-in. slot. Height from floor to table, 34 in. The press is equipped with a 3 h.p. motor in all cases except that of the four-ton press equipped for 200 in. speed per minute, for which a 5 h.p. motor is required. The machine is completely self-contained and ruggedly built.

Racine Vertical Feed Metal Cutting Saw

Racine Tool & Machine Company, 1770 State St., Racine, Wis., has brought out a power saw of the dry cut type in the design of which a simplified hydraulic feed principle is incorporated. The feed dial gives an infinite range of pressures from zero to maximum as required to cut all classes of material including mild and cold rolled, alloys, tool steels, high speed and stainless steel.

The hydraulic system consists of a simple plunger pump, cam-operated. Hydraulic pressure is applied to the top



Racine Vertical Feed Metal Cutting Saw

of the feed cylinder through a valve with numbered dial for varying the pressure. The entire hydraulic system with valves, cylinder and controls is self-contained in a removable cast iron case. The system is very compact, with provision for draining all possible oil leakage back to the oil reservoir. Three quarts of automotive crankcase oil are sufficient to operate the machine for many months.

The capacity of the machine is 6x6 in. The vise can be swiveled to 45 deg. Power is supplied through a V-belt drive from the motor to the drive gears and two speeds are available. The machine cuts very accurately at the rate of two to three square inches in mild or cold rolled steel per minute. Four-in. rounds are cut in eight minutes and 3-in. rounds are cut in five minutes.

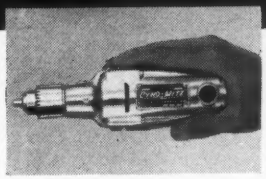
Hauser Type 2BA Precision Jig Boring Machine

The illustration shows the Hauser Type 2BA Precision Jig Boring Machine which is now being introduced in this country by The R. Y. Ferner Co., 161 Devonshire St., Boston, Mass. The features of the Hauser machine are maximum rigidity, exceptional drilling and boring capacity, durability, and an unusually large working range. Of particular note is the completely centralized control. From the operating position all controls are within convenient reach from the front of the machine.

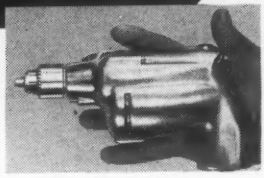
The spindle head, gear box and vertical slide form an independent unit as

"DYNO-MITE"

NEW
No. 400
¼"
PRODUCTION
DRILL



Top view showing how streamline design fits "Dyno-Mite" to the grip.



Side view showing relative size of "Dyno-Mite."

World's finest .. EVERY TEST IS POSITIVE PROOF

Actual working tests have shown conclusively that this little giant has no equal in the small production drill field. Here is a real tool, not a toy, capable of sustained high speed production WITHOUT OVER HEATING. Perfectly balanced and ingeniously ventilated, it can be operated indefinitely without discomfort. It is not only the smallest, lightest ¼-inch drill on the market (2½ lbs.) but also the most powerful. For work of a one-handed nature, no other drill ever made can be handled with such perfect control and so little fatigue.

Its simplicity of design and construction denote the skillful engineering of a finished tool. It can be taken down and re-assembled in five minutes. Quiet operation and long life are assured by heat treated chrome molybdenum helical gears, over-size Oilite spindle bearing, ball bearing armature and thrust bearings.

Write for complete details of this remarkable new drill and of the many other fine power tools in the important Millers Falls line. Ask us to demonstrate "Dyno-Mite's" superiority on your own work.

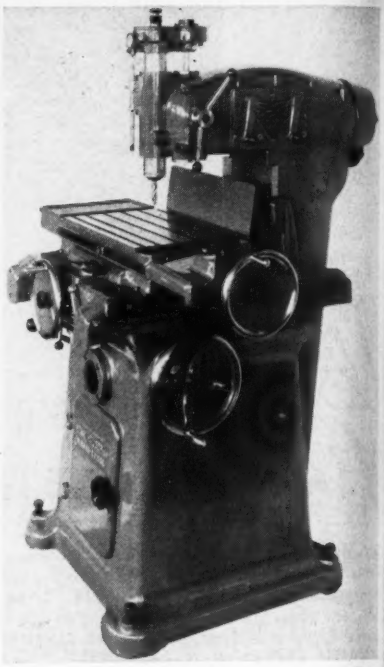
MILLERS FALLS TOOLS SINCE 1868

MILLERS FALLS COMPANY

Greenfield, Massachusetts

distinct from the machine base with the table and cross slide. The vertical slide member feeding into the machine base provides exceptional stability when drilling, as the guide length is greatly in excess of the overhang of the spindle head.

The table is set by the method of right angular coordinates, and the completely covered measuring system, which



Hauser Type 2BA Precision Jig Boring Machine

incorporates corrector bars, allows setting to be made to 0.0001 in. The measuring screws are of a special steel and are of large dimensions with suitably large thread flanks. The graduated dials and verniers are large and easily readable through glass covers. The clamping devices are operated by levers brought to the front of the cross slide. The clamping action is direct and positive. The table slots and front face of the table are in perfect alignment with the guides.

The spindle is operated by a 1 h.p. motor operating at 1400 r.p.m. The

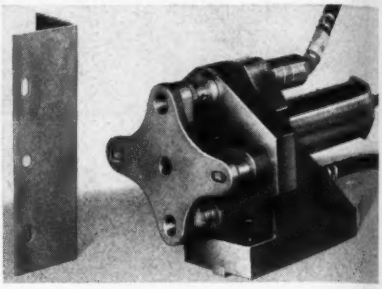
drilling capacity in cast iron is 23/32 in.; in steel, 19/32 in. Boring capacity is 1½ in. The working surface of the table is 17¾x12¼ in. Longitudinal movement of the table is 13¾ in. and the cross movement is 8 in. Maximum distance of spindle to table, 20⅞ in. Vertical adjustment of spindle head, 17¼ in. Vertical movement of spindle, 4 inches.

The spindle has a Morse No. 1 taper. Nine spindle speeds are available: 120, 180, 270, 400, 600, 900, 1300, 2000, and 3000 r.p.m. Feed of spindle per revolution, 0.003 inch.

The diameter of the circular table is 12 in. Angular reading is 5 seconds. The diameter of the inclinable table is 6½ in. Reading for circular table, 5 seconds; reading for tilting of table, 1 minute. Net weight of machine with motor, without circular table, 1540 pounds.

Progressive Hydraulic Self-Stripping Punching Units

Individual punching units that may be used in any production set-up or built into production fixtures by the manufacturer to suit his own specifications have been made available by Progressive Welder Co., 737 Piquette Ave., Detroit, Mich. The units vary in size from 1½ to 4-in. cylinder diameter. The pressures vary from approximately



Progressive Hydraulic Self-Stripping Punching Unit

2650 lbs. in the 1½-in. diameter to 19,000 lbs. in the 4-in. diameter. Cylinders vary in length from 8 in. to 10 in. The diameter of the stripper cylinder varies from ¾ in. in the 1½-in. model to 1 in. in the 4-in. model. Travel is ¾ in. on all types.

DO YOU LIKE *Flat Wire* WITH A SPRING-LIKE "FEEL"?

THE peculiar spring quality of our tempered High Carbon Flat Wire has impressed and pleased a large number of concerns who are "hard-to-please" buyers of this product. Great resiliency, straightness, and strict uniformity of temper are among the qualities which this wire possesses.

The particular Roebling spring steel shown below is a tape steel ...tempered, polished, and blued.

It is a very tough, resilient wire ... very accurate dimensionally, free of defects on the surface and edges, has high tensile strength, and is uniform in temper.

If you require cold rolled steel flat wire made up to exacting specifications... wire which calls for close attention to details and careful checking throughout production... it would pay you to investigate our product and our facilities. We specialize in this type of work and our organization is trained to handle it. We have had over 40 years of experience.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON, N. J. *Branches in Principal Cities*

Roebling
COLD ROLLED
STEEL FLAT WIRE

ONLY A FINE PRODUCT MAY BEAR THE NAME ROEBLING

The stripper cylinder, being hollow, also acts as a guide pin for the punches. The exterior is hardened and ground for wear and alignment. Each unit will cover a working area of approximately 8-in. diameter and as many punches can be mounted as this space allows and the capacity and size of the cylinder permit. Standard punches and dies are used and can be mounted on the heads in any location, and are as interchangeable on different jobs as the cylinders themselves.

The units can be operated singly, in multiple, or alternately as desired. Any reversing type hydraulic valve is suitable. In the operation of the punching unit, the stripper first positions the work against the die and by reversing the valve the punch follows through, piercing the holes. The punching unit may also be used for embossing or trimming on light gauge sheet metal parts. The units have full salvage value as only relocation and changing of the punches is all that is necessary to adapt the units to any production change.

Power of approximately 1500 lbs. pressure per square inch maximum is supplied by electrically driven hydraulic pumps. Any type of hydraulic pressure unit will operate these punching units, although Progressive supplies one especially engineered for this purpose. Special high production fixtures can be engineered by this firm as required.

M-B "Heavy Duty" Air Grinder

The illustration shows the M-B "Heavy Duty" Air Grinder, now being offered by M-B Products, 130 E. Larned St., Detroit, Mich. The features of this grinder are the three stages of power and three ranges of speed, together with a simple governor which regulates the maximum speed.

M-B "Heavy Duty" Air Grinder

Power is controlled by a series of three

PROLONGED CUTTING-POWER

The beaver's teeth are aces-high as long-duty cutting tools. So are Napier Band Saw Blades. Used in conjunction with the Horizontal Napier Band Saw Machine, they give 100% greater production per blade than is obtainable from an ordinary band saw machine blade . . .

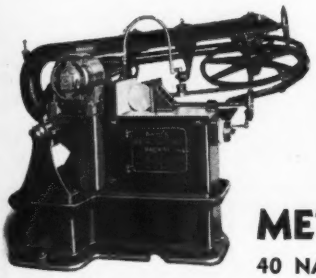
Because:

1. The Horizontal Napier machine has an automatic floating feed which eliminates destructive vibration.

2. Cutting compound is pumped onto the work in a continuous stream at the POINTS of the blade, thus scavenging the chips out of the gullets.

3. Large band wheels prevent checking in the gullets.

These factors—plus long life quality of Napier blades, secured to them by patented design of construction—assure 100% more work per blade. AND THE MOST EXPENSIVE NAPIER BAND SAW BLADE COSTS $2.46, INCLUDING ELECTRIC WELD.



Yet savings on blade-costs is but ONE of the Horizontal Napier's TEN advantages.

HORIZONTAL NAPIER BAND SAW MACHINE

METAL SAW & MACHINE CO.

40 NAPIER STREET SPRINGFIELD, MASS.

TEN OUTSTANDING FEATURES

1—Accuracy
2—Speed
3—Small Displacement
4—Prolonged Cutting Power
5—One Horsepower
6—Handles both Large and Small Work
7—No Time Out
8—Low Installation Cost
9—Low Depreciation Cost
10—Skilled Handling Unnecessary

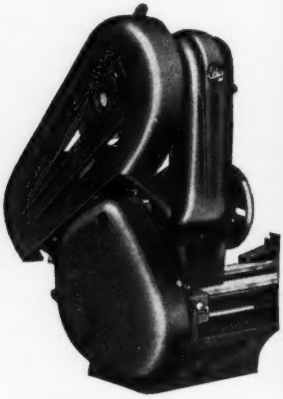
air jets and the grinder can be operated on any one of the jets. No. 1 jet makes available the minimum amount of power, No. 2 the intermediate stage and No. 3 the maximum volume, which is in excess of ¼ h.p. The air control is accessible and convenient, consisting of a knurled ring on the back of the body.

The three ranges of speed are obtained by the use of three different governor springs. By changing the governor springs, the maximum speed can be regulated to 25,000, 45,000, or 65,000 r.p.m. Thus the desired speed is available for any type of job. Furnished with each grinder is an adaptor for use in the tool post of a machine, affording a most efficient internal grinder.

The grinder is packaged in a finished hard wood case. Included with the grinder are the following accessories: oil resisting air hose with dirt filter, six mounted grinding wheels, two drop forged steel wrenches, two speed change springs, one adaptor to permit of using regular grinding wheels with ¼-in. holes, and one tool post adaptor.

Atlas Safety Belt Guards

Atlas Press Company, Kalamazoo, Mich., announces that belt shields are now available for any Atlas 9 or 10



Atlas Safety Belt Guard

Series Lathes with self-contained countershafts. The complete transmission of any recent Atlas lathe is fully enclosed after these belt guards are added.

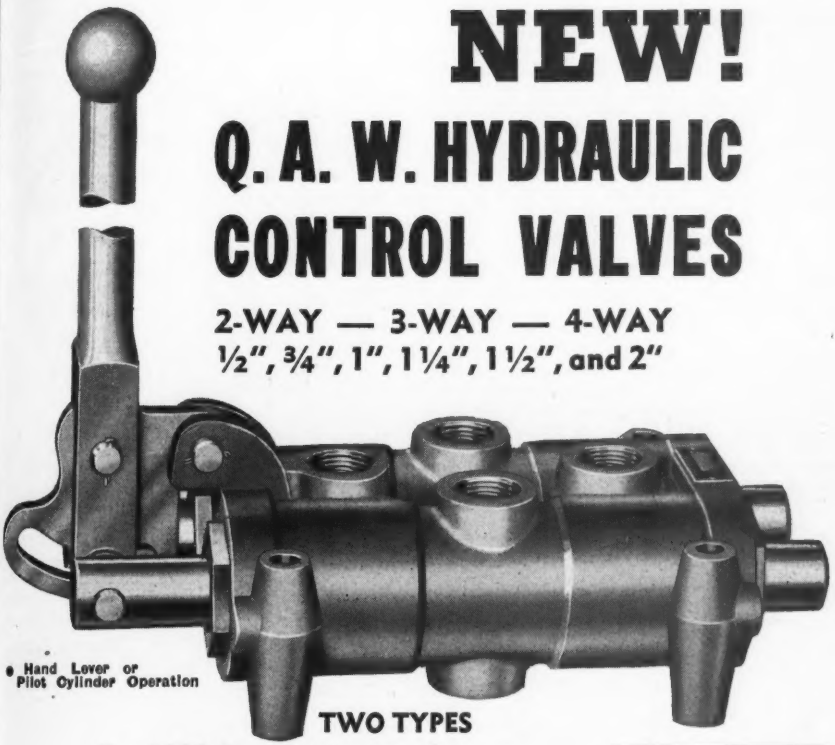
Both guards are aluminum castings with pin-hinges for quick raising and

NEW!

Q. A. W. HYDRAULIC CONTROL VALVES

2-WAY — 3-WAY — 4-WAY

½", ¾", 1", 1¼", 1½", and 2"



• Hand Lever or Pilot Cylinder Operation

TWO TYPES

For 1000 Pounds Working Pressure

For 2000 Pounds Working Pressure

Sizes including 1" available in heavy bronze forged housing recommended for water and corrosive fluids. Sizes 1" and under also available with housing machined from solid steel slab for oil or soluble oil solutions.

NO METAL-TO-METAL CONTACT

Built on the Q.A.W. principle of No Metal-to-Metal wear in the valving action, stainless steel plungers, short travel, and balanced action, these new values offer extremely long life in hard service. Inspection and re-assembly in a few minutes.

★

Write for complete new catalog of Air and Hydraulic Valves, "1 M" (key)

Quick-As-Wink Control

FOR AIR VALVES FOR WATER

C. B. HUNT & SON - SALEM, OHIO

DISTRIBUTORS IN PRINCIPAL CITIES

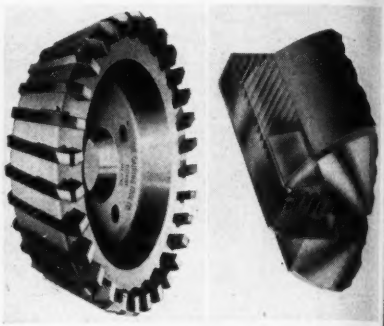
Representative in England: Gaston E. Marbaix, Ltd., London.

speed changes. It is not necessary to remove guards to change belts. The left guard covers the motor-to-countershaft belt and has a special inner guard for the pulley on the countershaft. The right guard covers belt from countershaft to lathe spindle. The entire assembly is ready-tapped for easy installation.

"Gair-Lock" Method of Locking Inserted Blades

A new method of locking adjustable, inserted blades in milling cutter heads, of interest to all users of single and multiple blade cutting tools, including boring bars, boring heads and reamers, has been developed by The Gairing Tool Company, 1629-35 W. Lafayette, Detroit, Michigan. The locking member, positioned in a shouldered recess adjacent to the blade slot, fits the serrated blade and locks it securely. Blade and lock are inserted lengthwise. The blade and lock are marketed under the trade name "Gair-Lock".

One of the chief advantages claimed for this blade design is the facility of adjustment. There are no wedges to drift out or upset. A tap on the rear of the blade releases it instantly and it can be set out the required distance. A single blade may be removed and replaced without loosening or removing any other blades in the cutter head. This is due to the freedom of the blade in the slot prior to Gair-Locking. Another advantage claimed is rigidity. The blades may be set at the correct angle

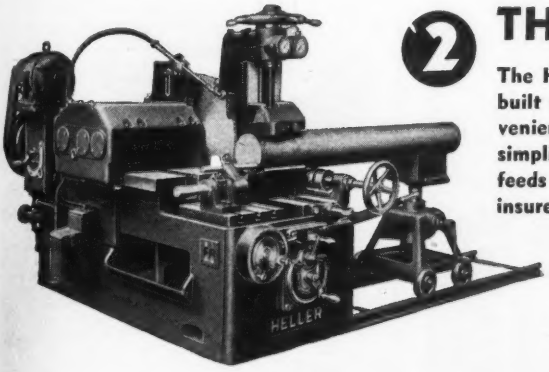


(Left) Milling Cutter with "Gair-Lock" Inserted Blades. (Right) Phantom view illustrating Gair-Lock method of locking cutter in position.

TRIPLE ECONOMY with HELLER

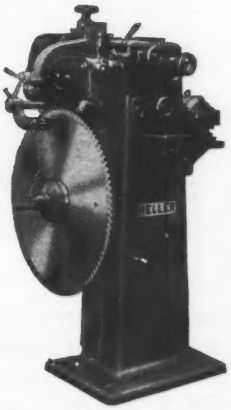
CIRCULAR COLD SAWING MACHINES

1 THE SAW The Heller blade is narrower, requiring less horsepower and wasting less material. These blades are furnished on a replacement basis — when segments are worn down, a complete blade is supplied for the price of the segments.



2 THE MACHINE

The Heller Hydraulic Cold Saw is built with the precision and convenience of a milling machine—simplified and foolproof — with feeds and blade speeds which insure maximum blade life.



3 THE GRINDER

The Heller Grinder brings the dulled blade back to original Heller Tooth Form. Installed with a machine, one man at no extra cost can handle both sawing and blade grinding to suit his own requirements and of the material being cut.

Centralized responsibility in Heller—for the Triple Economy assured in Blades, Machines and Grinders.

HELLER

HELLER MACHINE COMPANY

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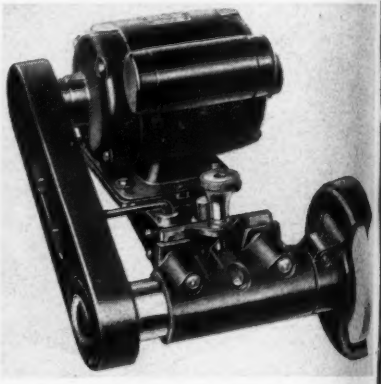
and rake to obtain solid tooth cutting action, approaching as closely as mechanically possible the condition of a solid cutter.

The Gair-Lock unit is said to prevent blade shifting or tilting, permits more blades per diameter, affords greater chip clearance, eliminates serrating of cutter body, makes special bodies for tungsten carbide blades unnecessary.

Dumore "Chief" No. 12 Lathe Grinder

A lathe grinder capable of precision internal and external work and adaptable to a wide variety of machine tools has been placed on the market by The Dumore Company, Racine, Wis. This grinder, known as the "Chief'," develops

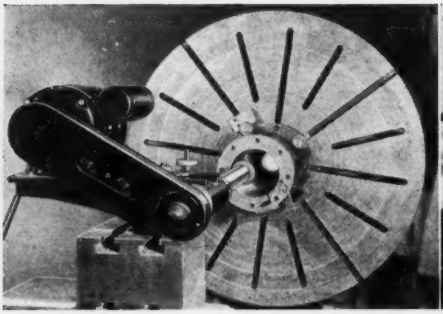


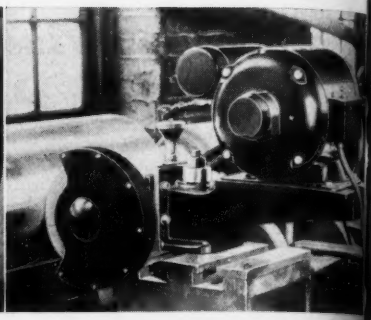
Dumore "Chief" No. 12 Lathe Grinder

one h.p. and is said to maintain precision tolerance on the heaviest production work.

The grinder is powered by a one h.p. capacitator motor which is dynamically balanced to eliminate vibration and preclude the possibility of chatter marks in grinding. The motor is said to deliver the maximum power output for its size, plus constant speed. Grease-packed split-tolerance ball bearings are used and the motor is fully enclosed to prevent dust and dirt from reaching the bearings, rotor and stator.

Power is transmitted from the motor to the quill by two No. 1 section V-belts. Proper belt tension is secured by adjusting the motor on its base. Six sheaves are furnished so that spindle speeds of 2800 to 8200 r.p.m are available, thus insuring the correct wheel speed





(Left) Dumore "Chief" Grinder set up for deep internal grinding, using a M-20 quill. This quill grinds to 20 in. deep on holes of 2⅜-in. diameter or larger. (Right) Dumore "Chief" Grinder set up in a large lathe for refinishing the piston of a large hydraulic hoist.

for wheels from 8 in. to 3 in. in diameter. Proper alignment of the motor and quill sheaves is assured by a slot in the motor frame and dowl in the base.

Six quills are available; one external and five internal—all capable of 0.0001 in. accuracy. All quills are equipped with the Dumore patented oiling system which lubricates each bearing with a constant fog of oil.

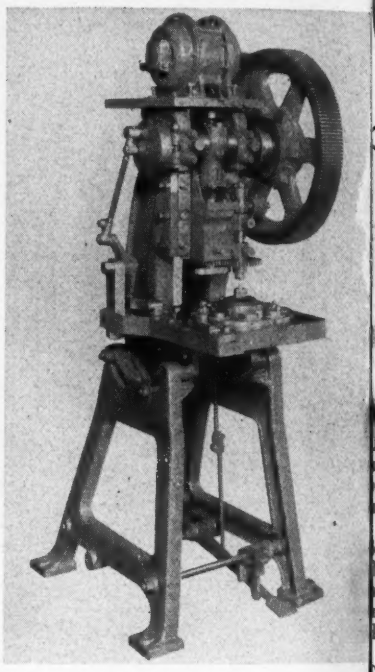
Equipment includes one wheel guard, six sheaves, two T-bolts, one belt guard, two V-belts, one No. 20 diamond dresser, one can Dumore oil, three wrenches, the necessary wheel collars, and shipping boxes for each quill, motor and bracket.

Toledo Special Automatic Press

The press illustrated in the above photograph was recently adapted by the Toledo Machine and Tool Co., 1420 Hast

ings St., Toledo, Ohio, division of E. V Bliss Co., for a special piece of work r quiring an eight-station dial feed f etching with acid, the trade-mark a number on hardened steel parts. A tached to the slide is a rubber stan die which is rotated 180 deg. at ea stroke of the press.

The back stamp die comes do touching a pad of acid, then on the ne stroke rotates 180 deg. to the front a applies it to the work which has be placed under the die by the dial fee



Toledo Special Automatic Press

At the same time that the die with t acid has rotated to the front, the d that was in front rotates 180 deg. to t rear to pick up more acid for the ne impression. Thus, a piece is etched f each stroke of the press and, contin ing around in the dial, is droppe through a hole in the bolster into container.

The press, itself, is a "Toledo" No. open back inclinable, with a 1½- stroke, 6-in. shut height on the bed a a 1-in. bolster. A ½ h.p., 900 r.p.

motor is geared directly to the flywheel supplying the motive power.

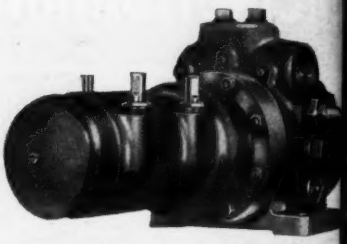
Sundstrand Model 10PWX & 5PWX Pump Units

The Sundstrand Machine Tool Company, Rockford, Ill., announces a line of hydraulic pump units with the control valves built into the pump housing. These units are extremely compact and are made in two sizes, the larger being the Model 10PWX and the smaller, the 5PWX.

An entirely new feature in the 10PWX unit is a variable displacement piston pump which can be furnished with three different feed rates: fast, medium and slow feed, each of which is independently adjustable. In addition there is a constant volume pump in this unit which provides rapid traverse. Both pumps are driven by a single shaft.

The main control mechanism is in the pump housing and may be actuated by a simple hydraulic remote control valve which is tripped by dogs on the moving member. An alternative control is electrical switches and trip dogs in conjunction with solenoid valves.

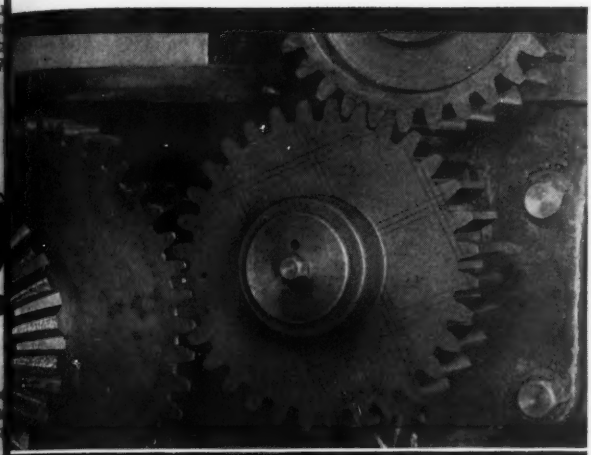
Either the hydraulic remote control or the electrical switches provide the th pre-set rates of feed and rapid trave in either direction. This same cont arrangement is used for the Model 5P



Sunstrand Model 10PWX Pump Unit

unit which like the standard Mo 10PWX, has two independently adju able feed rates in addition to rapid t verse.

The small size of these units toget with such a simple and flexible cont makes them ideal for machine tool fe and other applications. The pumps driven at motor speed 1200 r.p.m. a are quiet in operation. Extremely smo feeds are obtained due to the multi



ILENCE and SERVICE

RMICA gears, for many years, have proved that they are highly serviceable. When properly cut in the right they usually outwear metal gears. There is no grind creech, and as they are elastic they take up shocks in riving train and save the machine—especially if it is ct to spasmodic or reversing action.

dependability is well known to machinery buyers. And llent operation Formica gears make possible is a strong g point. They help to sell the machines.

ica gears also make life easier for maintenance engineers, buy replacement gears of Formica from the leading s named on this page.

HE FORMICA INSULATION COMPANY

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FORMICA

FORMICA
Gear Cutters

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The Akron Gear & En'g Co.
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Chicago Rawhide Mfg. Co.
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Perfection Gear Company
Chicago, Ill.
Gear Specialties, Inc.
Chicago, Ill.
Merkle-Korff Gear Co.
Chicago, Ill.
Chicago Gear Works
Chicago, Ill.
Foote Gear Works
Cicero, Ill.
The Cincinnati Gear Co.
Cincinnati, Ohio
Clarksville Foundry &
Machine Co.
Clarksville, Tenn.
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Diefendorf Gear Corp.
Syracuse, N. Y.
Worcester Gear Works
Worcester, Mass.
Massachusetts Gear & Tool
Co., Woburn, Mass.

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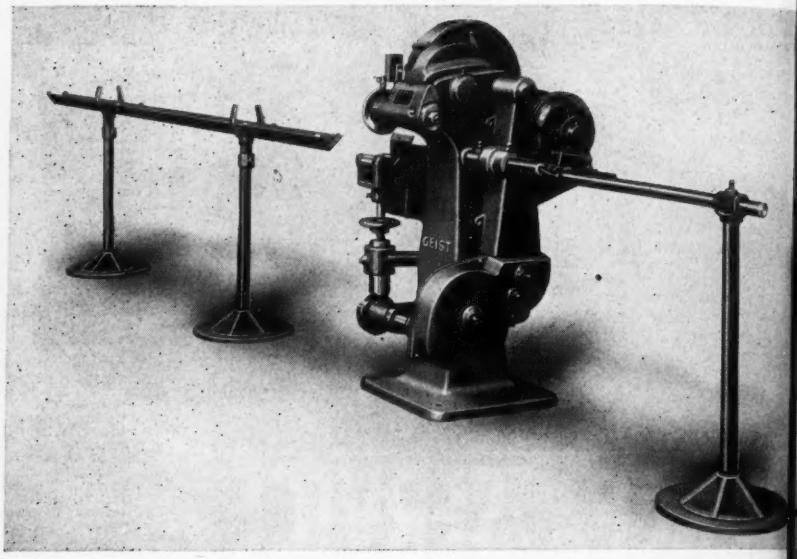


Geist Semi-Automatic Roller Cutter

piston pump design, which is an exclusive Sundstrand feature.

The 10PWX pump illustrated is provided with the three independent feed rates, an advantage which is highly desirable for wide facing operations as well as for boring, reaming and counterboring multiple diameter holes.

Geist Semi-Automatic Roller Cutter

The Geist Manufacturing Company, whose product is sold through the Landis Machinery Company, Waynesboro, Penna., has placed on the market a semi-automatic Roller Pipe Cutter in the operation of which the operator is relieved of all duty other than feed the pipe into the machine.

The machine incorporates many features of design, the most noteworthy of which is the operation of the rollers by a cam action. Both the hand and foot pedal have been eliminated. The movement of the rollers in a vertical plane is actuated by a gear driving disc cam. Separate cams are necessary for standard wall and extra heavy pipe.

The operating cycle of the machine is controlled through the medium of pick-off gears. The gear train is arranged so that by reversing one pair of gears, and employing an extra pair, furnished as standard equipment, four different speeds

Simple Change to the Modern Assembly Method eliminated tap breakage...

you standing the expense of tapping and ping troubles that could be avoided? A ker-Kalon Assembly Engineer will give an lased answer that may save you money.

re is the record on two of the hundreds of nufacturers of widely different products who e made sizeable reductions in assembly costs switching from machine screws to Parker-on Hardened Self-tapping Screws:

el-Chase Mfg. Co., Chicago, paid heavily for breakage and rejected parts when they were ping the formed steel rod handles which are ched to the 22 gauge steel body of their kers. A change from machine screws to Hex d type Self-tapping Screws ended the tapping trouble...saved approximately half of former mbly expense.

yman X-Ray Products Corp., Long Island , encountered high breakage of taps in alu-num alloys during assembly of frames for r film holder. By using Type "Z" Self-tapping Screws a 40 percent reduction was made in assembly costs, and assembly speed was doubled.

In both cases, the change in assembly method resulted in stronger as well as cheaper fastenings. For it has been proved that Parker-Kalon Hardened Self-tapping Screws hold better under vibration, tension and shear stresses than machine screws, bolts and nuts, etc.

Let us help you investigate this cost-cutting method of assembling metal and plastics

On your own work it is likely that fastening jobs could be simplified and economies effected by using Hardened Self-tapping Screws in place of ordinary devices. In 7 out of 10 cases where metal or plastic assemblies are required this method can be used to advantage for all or part of the fastenings. A Parker-Kalon Assembly Engineer will call on request to go over your fastenings with you and point out all opportunities. A letter to us obtains this service without obligation.

PARKER-KALON CORPORATION
Department M, 198 Varick Street, New York, N.Y.

PARKER-KALON *Modern* FASTENING DEVICES

A HARDENED SELF-TAPPING SCREW FOR EVERY KIND OF ASSEMBLY

SOLD ONLY THROUGH RECOGNIZED DISTRIBUTORS

are available. The speeds are fixed so that it is possible to cut off from 10 to 35 nipples per minute depending upon the pipe diameter. A removable cover protects the gear train.

The Geist Roller Pipe Cutter is equipped throughout with anti-friction bearings, a heavy duty roller bearing being used on the cutter disc spindle to assume the thrust load of a heavy cut. A high pressure greasing system is used to insure positive lubrication.

Another feature of this new Roller Cutter is the lubricator, built into the machine for lubricating and cleaning the cutter disc. The lubricator, adjustable for any diameter of disc, consists of a reservoir that holds about one pint of oil. A needle valve controls the flow of oil permitting just enough lubricant to flow into two felt pads which are in constant contact with the cutter disc under spring tension. This insures positive and continuous lubrication.

A new type of pipe support replaces the old type pipe stand formerly furnished with this machine. This new support is in the form of a trough which eliminates the gripping of the pipe while under cut. The trough is 10 feet long and is lined with a series of metal strips so placed as to minimize any friction between the pipe and t trough. These strips form a bearing which the pipe rotates and permit m rapid advancement of the pipe after cut-off operation has been comple The trough is mounted on a new t of support. A quick action clamp ables the operator to raise or lower support quickly to any desired hei Arms extending above the trough eli inate the possibility of the pipe fall out.

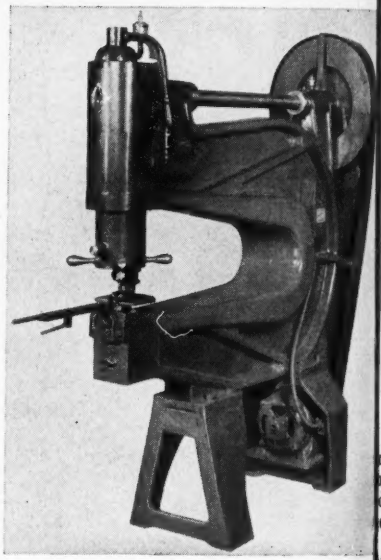
Savage Nibbling Machines Redesigned

W. J. Savage Company, Knoxvi Tenn., has re-designed their line of S age Nibbling Machines. These new m chines are considerably improved in t exclusive features, such as Direct-Ov Center Drives, totally enclosed he and one-piece revolving heads are inc porated. The new nibbler is more po erful, has fewer working parts and safer and easier to operate. There no moving parts in the streamlined erating heads except the metal cutt tools. Fast and accurate cutting is complished by guide template or to scribed line. Alloy steels may be

as easily as boiler plate, and the ne machines are sufficiently powerful punch starting holes to one-half ra capacities. This feature is quite an a vantage when inside cutting is requir

A few exclusive features in this ne and improved nibbler are:

1. Direct-Over-Center-Drive, whi increases power in nibbling a punching starting holes.
2. Totally Enclosed Head protec working parts and operator, a provides better lubricating met ods.
3. One-Piece-Revolving Head p

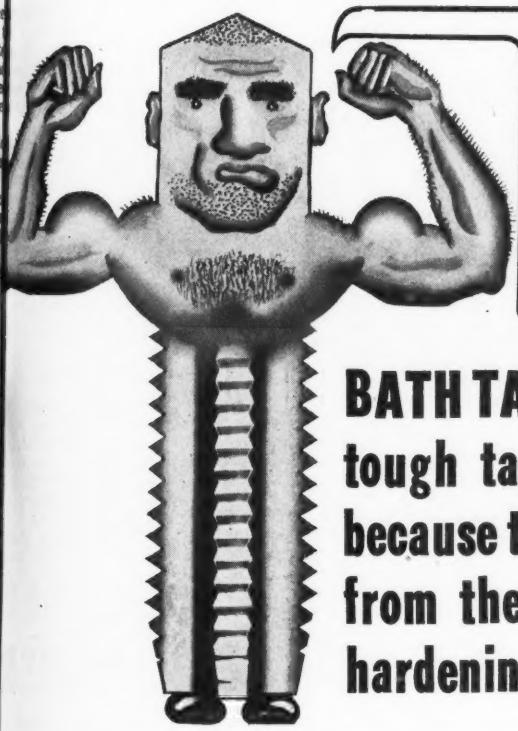


Savage Redesigned Nibbling Machine

vides fewer working parts an more substantial operation.

4. Combination Collet and Ra Lock holds tool in place whil tightening and simplifies to changing.
5. Re-designed Main Frame provide additional strength and bette balance.

The new Savage Nibblers are conser atively rated to cut from ⅛ in. to ½ i thick sheet metal and have a range throat depths from 8 in. to 36 in. t handling sheets in any length and fr 16 in. to 72 in. wide. The older ty metal cutters manufactured since 19 with capacities for cutting ¾ in. m



TOUGH TAPPING JOBS ARE MY MEAT

BATH TAPS can handle tough tapping jobs because they're ground from the solid after hardening . . . .

In the Bath hardening process, blanks are hardened, tempered, roughened and *then* the teeth are ground. Thus, the thinnest edges of the teeth have the same perfect grain structure as the heart of the tap.

As a result, these perfect teeth stay sharp longer, cut more accurately and allow more tapped holes per tap.

For you, this method means lower costs, greater accuracy, and higher production—in a word, greater profits.

Why not give BATH TAPS a chance to handle your tapping problems—especially the tough ones?

JOHN BATH & CO., Inc.

WORCESTER, MASS.

IT PAYS TO BUY BATH "Ground From The Solid" TAPS

steel, have also been improved in design and construction.

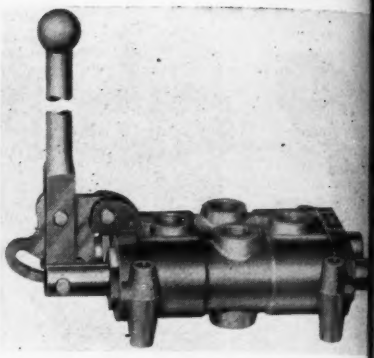
Hunt Hydraulic Valve

The C. B. Hunt & Sons Company, Salem, Ohio, has brought out a hydraulic valve the design of which embodies the same no metal-to-metal wear principle and minimum of moving parts as characterizes this company's already well known line of "Quick-As-Wink" Air Control Valves.

Illustration shows bronze forged housing valve hand lever operated, for 4-way operation. This valve is also built for 2-way and 3-way operation and is made in ½-in., ¾-in. and 1-in. sizes, in two styles, for 1000 pounds working pressure and for 2000 pounds working pressure. The bronze forgings used as housings are among the largest bronze forgings ever made.

The employment of the dropped forged bronze housing with its high physical strength affords an additional factor for long life with water or corrosive fluids.

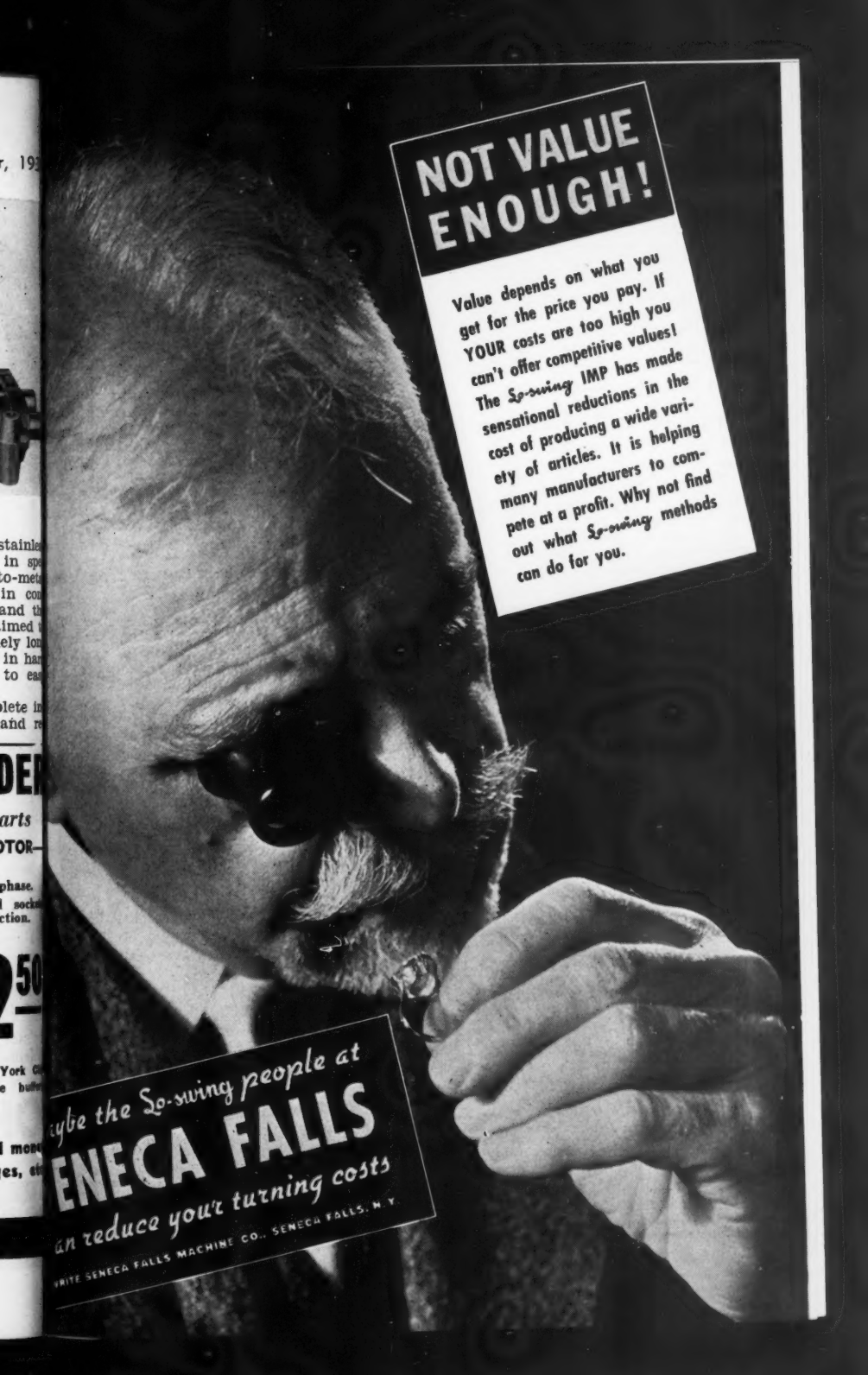
In the "Quick-As-Wink" valving principle, the valving operation is accomplished in the 2-way valves by only one moving part; in the 3-way and 4-way valves by coincident motion of two valve bodies or plungers. The valve



Hunt Hydraulic Valve

bodies or plungers are made of stainle steel. These are "free-floating" in sp cial packings, avoiding metal-to-met contact. Balanced port action in co junction with the valving ring and th no metal-to-metal contact, is claimed provide a combination for extremely lo life and satisfactory performance in ha service. Short travel is an aid to ea operation.

Accessibility is such that complete in spection replacements of parts and re


NOT VALUE ENOUGH!
Value depends on what you get for the price you pay. If YOUR costs are too high you can't offer competitive values! The So-swing IMP has made sensational reductions in the cost of producing a wide variety of articles. It is helping many manufacturers to compete at a profit. Why not find out what So-swing methods can do for you.
ybe the So-swing people at
ENECA FALLS
an reduce your turning costs
RITE SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

assembly can be made in a few minutes and without disturbing the hydraulic piping. Connections are provided so that piping may be permanently connected above or below housing. The only internal moving parts, the stainless steel valve bodies or plungers in several years of hard, continuous service have shown imperceptible wear due to valving action, in millions of operations. Complete new catalog of "Quick-As-Wink" Air and Hydraulic Control valves is now available.

Electroloy Cold Formed and Plated Electrodes

The Electroloy Company, Inc., 50 Church St., New York, N. Y., announces two major improvements in the line of electrodes marketed by this firm.

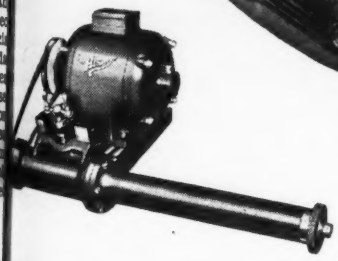
In place of the conventional machined spot welding tip, this company now offers electrodes cold formed under tremendous pressure and employing Electroloy standard highly conductive alloys. The cold forming is said to produce a fine, uniform grain structure with an additional 10 to 12 per cent increase in adherence. This construction is claimed to result in a minimum of mushrooming or deformation of the electrode a consequently an increase in the numb of spot welds per tip.

According to this company, resear has indicated that considerable loss current and overheating of the electro has been caused by oxidation on t surface of the electrode at its point contact with the adaptor. To recti this condition, the Electroloy Compa now plates electrodes with a thin ele trically conductive coating of a speci alloy which is highly resistant to oxid tion. This plate is said to result in le heating of the electrode and cons quently less softening and deformatio Standard tapered electrodes in all si and incorporating both of these i provements are now available. Samp for test purposes will be forward gratis upon request.

Safety Tu-Way Hammer or Vis Belt Lacer

With a hammer and the new "T Way" Belt Lacer now being made b Safety Belt-Lacer Co., Toledo, Ohio, t belt can be laced with a lacing practi cally the same as that procured with t usual type of belt lacer. Or, if a vi

RIGHT—A 3 H.P. Wide Range Precision Grinder shown set up for external or surface grinding.



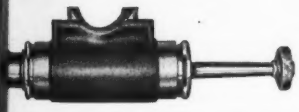
AT LEFT—A 1 H.P. Wide Range Precision Grinder shown fitted with Internal grinding spindle.

NOW YOU CAN GRIND IT!

No matter how well equipped a Grinding Department may be, a job will turn up which cannot be handled. Perhaps it is a shaft which is too long for the cylindrical grinder, a roll too large or a plate too wide for the surface grinder. A "HISEY" Wide Range Precision Grinder mounted in a lathe, boring mill or planer will save the day.

With interchangeable heads, these Grinders do external, internal or surface grinding operations. They are capable of extreme accuracy and are ruggedly built for production work.

Sizes range from ¼ to 10 H. P. capacity in a number of different models.



An Internal Grinding Head with open spindle. Is interchangeable with heads of above machine.

New Bulletin No. 51-M gives complete information.

THE HISEY-WOLF MACHINE CO.

"It's High Grade If Hisey Made"

Hisey

Established 1896

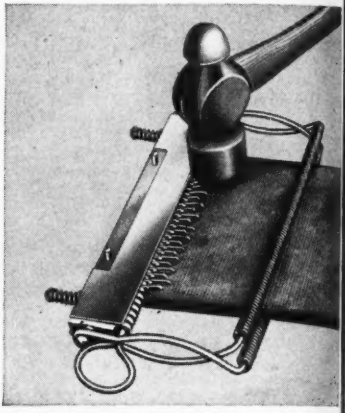
CINCINNATI, OHIO, U.S.A.

Electric DRILLS . . . GRINDERS . . . BUFFERS

is handy, the lacing may be made in a vise.

To lace with a hammer, a strip of "Safety" Belt Hooks is cut to the desired length and inserted into the lacer magazine as far as they will go so that the retaining pin may easily be inserted. The belt is then inserted between the spiral spring pressure jaws and the end of the belt is pushed squarely and firmly against the magazine. With the hooks resting on a hard, smooth surface, such as a steel plate, the hooks are hammered in, a few at a time and only partly in until all are set. The hammering is then repeated until the hooks are even with the surface of the belt. The best results are obtained by using hoo of the proper size for the thickness the belt.

For vise lacing, the belt is inserted b



Using the "Safety" Tu-Way Belt Lacer

tween the jaws and against the mag zine as described above and the lacer then inserted between the jaws of t vise. The jaws are now tightened un the hooks are properly imbedded.

This lacer is light, compact and such simple design that it can easily carried about the plant—or away fro the plant if necessary. It will easily into an average tool kit and will neith take up much room nor add much the weight of the kit.

Sunnen Junior Cylinder Hone

Introduced several years ago by t Sunnen Products Company, St. Lou Mo., for cylinder grinding work on a

stins, ice machinery, outboard motors, light plants, compressors and other motors with small-bore cylinders, the Sunnen Junior Cylinder Grinder is proving an exceptionally handy piece of shop equipment for use on the Ford V-8 "60" motor blocks and other motor cylinders of similar size.

Sunnon Junior Cylinder Hone

Employing the same operating principle as the famous Standard Sunnen Grinder, the Junior Model uses two stones and two non-cutting guides to produce a straight, round hole no matter how badly scored, bellied, or bell-mouthed the cylinder may be. Like the larger grinder, it can be operated at any angle and adjustment is fast, easy and positive. The Junior Grinder will remove from two to three thousandths-inch of stock per minute with a guaranteed accuracy of half a thouandths of an inch. Stones can be changed from roughing to finishing in thirty seconds.

"Pretty Neat" Drawing Board

"Pretty Neat" Drawing Board

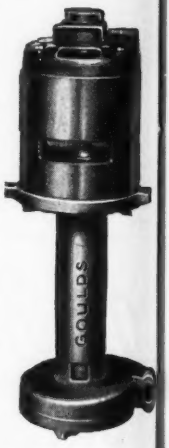
For the use of plant executives w may wish to make drawings at t desks, or of engineers who may wish make sketches on the job, H. E. Tw ley, 7154 Magnolia Ave., Riverside, C has brought out a drawing board wh weighs less than one pound and is o ¼ in. thick. Although compact, board is extremely efficient, simple

use and complete in detail, requiring no thumb tacks or T-square. The board is made of composition and is perfectly smooth on the surface. A raised edge, ⅛ in. high and ¾ in. wide, provides a square surface against which a triangle can be located for drawing the vertical and horizontal lines. An 8-in. 45x45 deg. triangle is recommended; although other sizes will be found satisfactory.

Necessity for thumb tacks is eliminated by the use of spring clamps in the corners which can be raised by means of push buttons on the underside of the board and which will hold the paper firmly in position. The board is slightly over 8½x11 in. inside the raised sides thus it will take paper of ordinary standard stationery size. The board is, however, also available in 9x12-in. and 15-in. sizes.

Goulds Vertical Centrifugal Coolant Pump

Goulds Pumps Incorporated, Seneca Falls, N. Y., has brought out a small compact, vertical submerged type centrifugal pump designed especially for the circulation of coolant, cutting compounds, or similar liquids containing abrasives in suspension. The pump is built only in the ¾-in. size and is designed to occupy the minimum of space in installation.



Goulds Vertical Centrifugal Coolant Pump

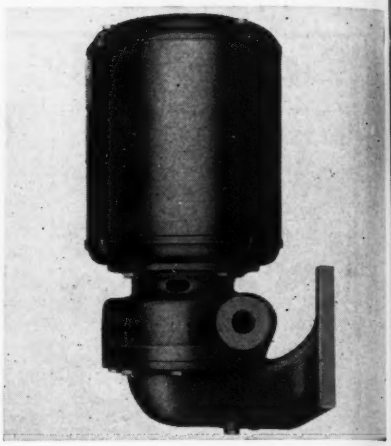
The impeller is of open, double suction type, hydraulically balanced to eliminate end thrust. The impeller is mounted directly on a large diameter extended motor shaft, eliminating necessity of any lower pump bearing. The pump casing is cast integral with the motor support, at the top of which the motor is held in position with male and female lock to assure permanent alignment. The clearance between the impeller and casing is sufficient to remove the possibility of bind

ing from chips. There are no pockets in the casing in which chips may collect.

The pump is made in capacities up to 30 gal. per minute and heads up to 19 ft. The motor is ¼ h.p., 1750 r.p.m.

Pioneer Vertical Bracket Coolant Pump

A new model pump known as the "VB" has just been brought out by the Pioneer Engineering & Manufacturing Company, 31 Melbourne Ave., Detroit, Mich., for use in handling coolant or lubricant for machine tools. It is a compact, self-contained unit that bolts directly to the side of the machine base or coolant reservoir.



Pioneer Vertical Bracket Coolant Pump

The pump requires no suction piping. The intake is directly through the base bracket. Its general construction and installation makes the entire unit readily accessible. It is simple to install and easy to remove. The whole unit may be dismounted simply by removing the set of flange bolts. The pump itself is likewise accessible for either inspection or servicing.

As will be noted from the accompanying illustration, the pump itself is mounted directly on the end of the motor. There is no long shaft to whip, vibrate, or cause trouble. It is a close coupled unit which maintains its high initial efficiency for an unusually long service period.

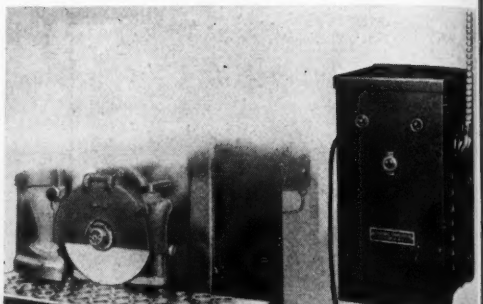
Although it will be used largely for coolant supply, the liquid handled by this unit does not have to have lubricating properties. Any type of liquid not too highly corrosive or viscuous may be pumped. Another advantage of the use of this unit is that no relief or by-pass valves are needed in the delivery line. Any degree of throttling may be accomplished without increasing the load on the motor.

Mellaphone Rectifier Produces DC Current for Magnetic Chuck

To meet the need for a simple and dependable current source in the tool room, the Mellaphone Corporation, Rochester, N. Y., has brought out an electronic rectifier using a mercury vapor tube. This rectifier is easily installed, requiring only connections from an AC line and a cord from the chuck switch.

There are no moving parts to wear out and the use of the well known mercury vapor rectifier tube assures long trouble-free life. Dust, grit and moisture cannot affect it. The high efficiency and simple construction which is characteristic of all electronic rectifiers accounts for the low first cost and operation. A standard full-wave circuit is used.

This rectifier can be supplied to work from either 110 or 220 volts AC and de-



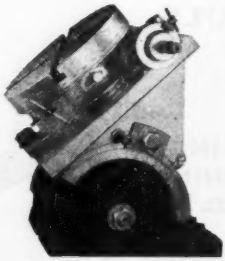
Mellaphone Rectifier which Transforms Alternating Current to Direct Current for Operation of Magnetic Chuck

liver 110 or 220 volts DC to the magnetic chuck. The model pictured here operates on 110 volts AC with a capacity of 220 watts output.

Stevens No. 1 Adjustable Angle Tilting Table

John B. Stevens, Inc., 306 Hudson St., New York, N. Y., have brought out an adjustable angle tilting table to meet the demand for a tilting fixture for use in connection with either of the two types of 7½-in. rotary tables made by this firm, as well as for mounting vises or other holding fixtures for adjustable angle machining.

The top or swiveling section of the fixture can be swung by means of a rack and pinion and readily bound at any point between a vertical and horizontal position. A ⅝-in. keyway runs lengthwise of the top surface. Care has been taken in the design to keep the height at a minimum, and to make every part thoroughly substantial.



Stevens No. 1 Adjustable Angle Tilting Table

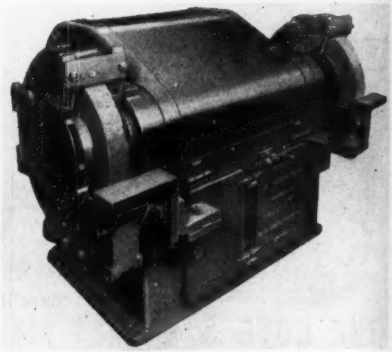
The size of the top section is 6½x10 in., and the height in a horizontal position is 6½ in. The height to the top of the 7½-in. rotary table when mounted is 9 13/16 in. Net weight, 57 lbs. Net weight with rotary table, 94 pounds.

Kling Grinder Has Wheel Wear Compensator

The Type "AT" Grinder which has been brought out by Kling Bros. Engineering Works, 1301 N. Kostner Ave., Chicago, introduces the Wheel Wear Compensator.

By turning a handle, the wheel speed is increased, making it possible to maintain an approximate peripheral speed

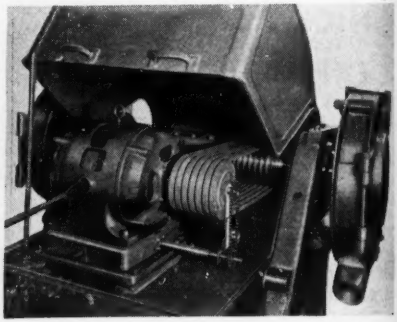
of 8500 surface feet per minute overcoming the production drop-off in cleaning and snagging operation because of wheel wear. As a safety factor, a lever mechanism between the spark guards and the compensator prevents "worn



Kling Type AT High Speed Heavy Duty Grinder

wheel speeds" with new wheels as the speed must be reduced before guard can be raised to install a new wheel.

Handy pushbutton on front of base actuates a magnetic switch inside. Motor shaft is mounted on same plane as wheel shaft to reduce vibration. Shaft



Showing Wheel Wear Compensator on Kling Grinder

is split for easy replacement of belts, and is securely held together by a heavy coupling.

Vari-Pitch Texrope Sheaves with 7 belts provides non-slip drive. Motor has tension adjustment in base. Large supporting bearings close to wheel

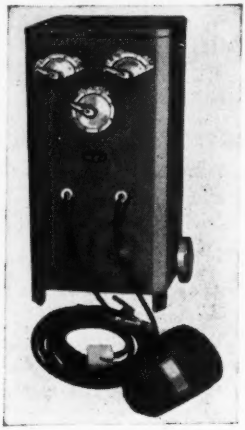
chucks insure maximum bearing life. Smooth "streamlined" exterior eliminates all unnecessary angles where particles may lodge. A special work rest with pedal control is available with the Type "AT" for production grinding.

It is claimed by the manufacturer that, because of the Wheel Wear Compensator, production can be greatly increased on the snagging and high speed grinding work as the controlling of wheel speeds as they become worn is simply a matter of turning a conveniently located handle.

Literature is available on the new device from the makers at their Chicago office given above.

Miller Dual Control Welder

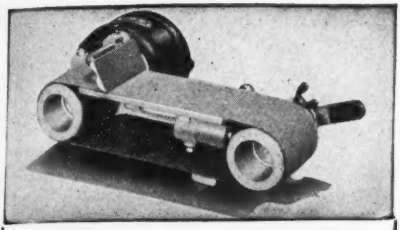
An A. C. Welder with separate voltage and amperage controls, enabling the operator to select the most desirable voltage for the amperage used on any



Miller Dual Control Welder

job, has just been put on the market by Miller Electric Manufacturing Co., Appleton, Wisconsin. This welder, known as "Dual Control" furnishes practically unlimited current settings. It is easy to operate; the three dials on the front of the cabinet are plainly marked, and it is compactly built but heavily constructed for hard usage.

Built in three sizes with a current range from 10 amperes to maximum output that makes possible welding of sheet metal or heavy metal, this welder is



• NEW An Inexpensive ABRASIVE BAND GRINDER . . .

"Built Like a Machine Tool"

The Hormel-M Grinder is sturdily built with a supporting leg under the grinding table to eliminate vibration and tipping due to pressure on the belt. Ball bearing throughout. Equipped with **ALEMITE LUBRICATION** complete with grease gun.

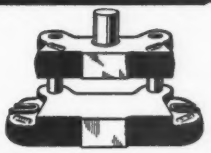
Write for illustrated folder on this and other styles and sizes.

HORMEL-M GRINDER

WALLS SALES CORP.

96 WARREN ST. NEW YORK, N. Y.

BAUMBACH



STANDARDIZED DIE SETS

Machined Steel — Semi-Steel

DROP FORGED STEEL

Standardized Die Sets, embodying many exclusive features, and a listing of more than 185,000 stock sizes, afford a service that is unsurpassed.

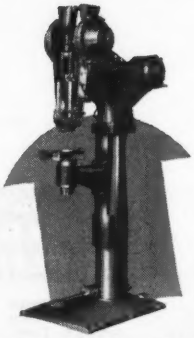
Send for Our New 288 Page Catalog

E. A. Baumbach Mfg. Co.

1806 S. Kilbourne Ave., Chicago, Ill.

LOW COST *Production*

—THE RESULT OF THIS ENGINEERING SERVICE



Complete line of automatic riveters for setting up to 4 rivets at a time.

More and more, industry has learned that it pays to take advantage of the engineering service offered by this company. Consultation in the period of assembly design many times results in minor changes permitting lower costs thru standardization, improved service and often economies thru multiple rivet setting. Where this preliminary consultation is not permissible send blue print or preferably sample assembly for production study and analysis involving the use of tubular or split rivets.

CHICAGO RIVET & MACHINE CO.

1846 S. 54th Ave., Cicero P. O., Chicago Ill.

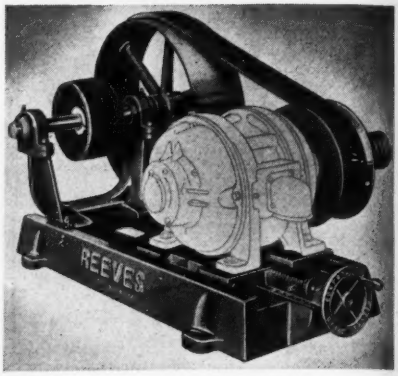
Chicago

ONE OF THE WORLD'S LARGEST MANUFACTURERS OF RIVETS AND RIVETING EQUIPMENT

equipped with wheels and a handle so that it is as portable as a truck. All three sizes have the same cabinet dimensions and vary in weight from 235 lbs. to 350 lbs., furnished standard for 220 volts.

Reeves Improved Vari-Speed Motor Pulley, Countershaft Type

Reeves Pulley Co., Columbus, Ind., manufacturer of Reeves variable speed control equipment, has developed a new and improved design of the Vari-Speed Motor Pulley countershaft type.



Reeves Improved Vari-Speed Motor Pulley, Center Shaft Type

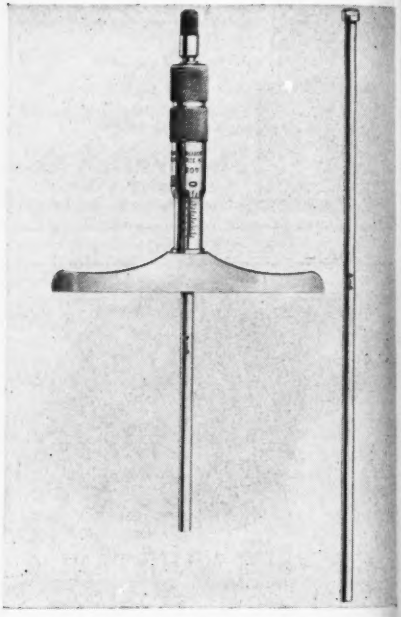
The Vari-Speed Motor Pulley is a simple, conpact variable speed unit which is mounted on the standard shaft extension of any constant speed motor. It forms direct drive from motor to driven machine. Through handwheel control, a sliding base on which motor and unit are mounted is moved forward or back, varying the diameters of a set of adjustable discs from which a V-belt runs to the driven machine. Desired speed changes are made as the belt runs from maximum to minimum disc diameters.

For requirements of either unusual speed reduction or speed increase, a countershaft is mounted on a common base with the rest of the unit. In the design illustrated, this pulley may be mounted in the center of the countershaft, between the two bearing housings, thus providing a compact, space-saving unit in installations where this factor is important.

While a straight-face pulley is illustrated, power take-off may also be from sprocket, pinion, multiple V-belt, sheave or any other accepted drive. The countershaft supports are extremely strong, rigid and heavily braced so there is no possible chance of vibration or twisting in the countershaft. The Reeves Vari-Speed Motor Pulley is built in seven sizes, transmitting from fractional to 7½ h.p., and covering speed ratios of 3:1.

Brown & Sharpe No. 607 Micrometer Depth Gage

A micrometer depth gage has been made available by Brown & Sharpe Mfg. Co., Providence, R. I., in a new size



Brown & Sharpe No. 607 Micrometer Depth Gage

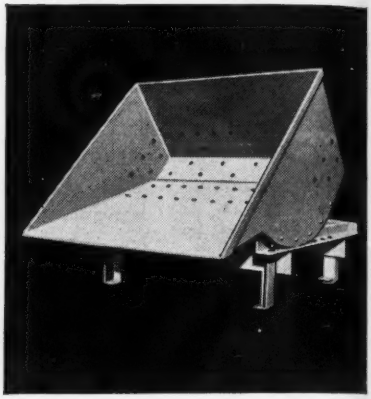
measuring from 3 to 9 in. in depth. The micrometer screw has a movement of 1 in. and the range of 3 to 9 in. is obtained by the use of six measuring rods. The measuring rods are of ample rigidity, being 3/16 in. in diameter. The ends of the rods are hardened.

The base is approximately 9/16 in. thick, 4 in. wide, and hardened. The

desired rod is easily and quickly inserted in the gage through a hole in the micrometer screw. The positive setting arrangement for the interchangeable measuring rods comprises a desirable feature of this gage. The design also makes it possible for the gage to be furnished with a ratchet stop.

Roura Dump Hopper

A new dump hopper, for use in connection with hand or power lift trucks, for handling raw materials, parts, waste or finished products, and designed especially for loads that are hot and for service in departments where the equipment is subjected to high heats, has been brought out by Roura Iron Works, Detroit, Michigan.



Roura Dump Hopper

The hopper is arranged for side dump and is also furnished for end dumping. Special alloy steel is used in its fabrication and sides and bottom are perforated, both precautions being taken to enable the hopper to resist warping. The hopper is furnished on legs or casters with any specified underclearance, and has one yard capacity. It is equipped with a single latch which holds the load securely in position and when unlatched, enables the hopper to be emptied promptly and cleanly.

Ryerson Announces Certified Steel Plan

Joseph T. Ryerson & Son, Inc., Chicago, Ill., has announced a new, unique plan to aid steel users in securing more uniform and satisfactory results from their steel. The system, to be known as the "Ryerson Certified Steel Plan", undertakes to select entire heats of alloy steels that have particularly desirable qualities and come within certain narrow analysis limits, make thorough tests for chemical and heat treat characteristics, and prepare complete data concerning the analysis, tests, and so on, for delivery to the customer who buys the steel. The plan is of particular value on the alloy steels that usually require heat treatment before use, and will solve many of the problems that

JOSEPH T. RYERSON & SON, Inc.

S. A. E. Type 4615-20 Heat Symbol L H

HEAT ANALYSIS

C. .16 Mn. .52 Phos. .018 S. .036 Si. .27 Ni. 1.94 Cr. ..... Mo. .29 Va. .....

Inherent Grain Size 5-8 Inclusions — (Automotive Classification) Oxides 3 Silicates 2

CARBURIZING CHARACTERISTICS OF THIS HEAT

1" Round Carburized 8 Hours at 1700 Deg. F.

Cooled in Pot. Reheated to 1475 °F. Quenched in Oil

Case Physicals	Hardness	68 Rockwell C.
	Depth	.039 Inches.
Core Physicals	Tensile Strength	119,000 Lbs. Per Sq. Inch
	Yield Point	91,000 Lbs. Per Sq. Inch
	Elongation	21 % in 2 inches
	Reduction of Area	60 %
	Brinell Hardness	240

This chart shows actual analysis reported by mill on heat indicated by symbol letters. It also shows results of case hardening test made on a one inch round sample taken from this heat. These figures may vary from one part of the heat to another due to permissible segregation and normal variation of analysis determinations.

This information is given for the guidance of our customers in determining the best heat treatment for this steel, but it will not be accepted as a basis for rejection of material nor establishment of claims. Do not neglect to consider effect of mass on the results developed by heat treatment.

Ryerson Certified Alloy Steel Data Sheet for the case carburizing steels. These data sheets are made up on every heat of steel placed in stock. When carburizing steel is ordered, one of these data sheets is sent to the customer.

have developed with the increase in the use of alloys.

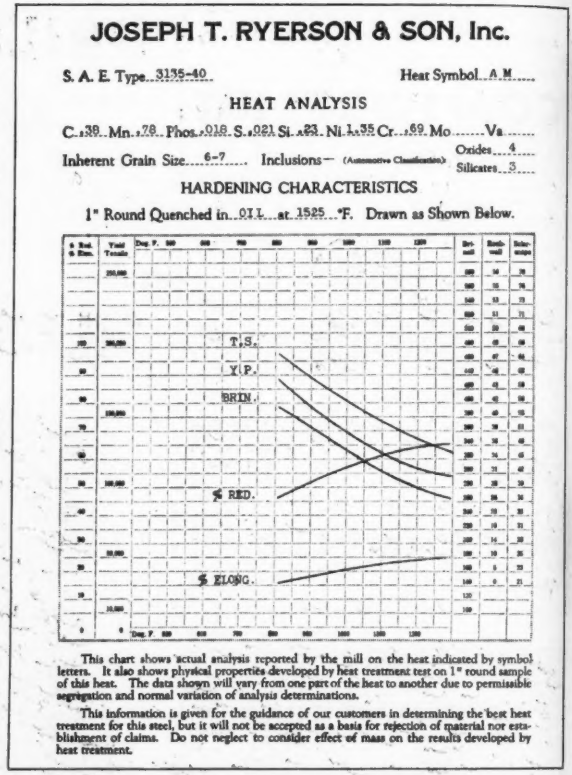
The Society of Automotive Engineers has compiled a set of specifications covering the great majority of alloy steels in use today. In compiling these specifications, the engineers have worked with the steel producers and have narrowed the limits of composition as far as it is practical for the steel manufacturers to follow. The limits are relatively wide however, and therefore steel ordered only by S.A.E. specifications may vary greatly in heat treatment response from one heat to another. This response depends partly on analysis and partly on the general hardening characteristics of the particular heat in question, these characteristics being governed by the structure of the steel, inherent grain size, and so on. The variation frequently results in uniform results and the extra expense of retreatment.

When large tonnages are involved, a user can purchase whole heats and it is then practical for him to analyze each heat and test it for heat treatment response. In this way he is able to control his heat treatment process so as to offset any differences between heats. When average lots of alloy are purchased from stock, however, the customer can hardly afford to run analyses and heat treatment tests on the different bars. Therefore, the only solu-

tion is to serve him with alloy steel that has already been analyzed and tested before he gets it. Ryerson has been seeking to solve this problem for many years.

To accomplish the desired result Ryerson had two fundamental problems to overcome. The first was to secure standard alloy steels for stock which conformed to an analysis range closer than S.A.E. specifications and which were closely controlled in general hardening characteristics. The second problem was to develop a method of informing each customer of the complete analysis and heat treatment characteristic of each bar shipped to him.

The first problem was solved by specifying, for all their alloy steels, a much closer chemical analysis basis than the standard S.A.E. specifications and including in these specifications factors governing the heat treat responsiveness of each type of steel. Only the heats are selected which come within this restricted range, and are then identified by letter symbols and later rolled into bars bearing the same letters. Identification letters are stamped on the end of each bar and in the case of small bars the bundles are tagged. Thus all bars produced from a given heat carry the identification letters assigned to that heat. The only problem remaining was



JOSEPH T. RYERSON & SON, Inc.

S. A. E. Type 3135-40 Heat Symbol A M

HEAT ANALYSIS

C. .39 Mn. .78 Phos. .016 S. .021 Si. .23 Ni 1.35 Cr. .69 Mo ..... Va .....

Inherent Grain Size 6-7 Inclusions — (Automotive Classification) Oxides 4 Silicates 5

HARDENING CHARACTERISTICS

1" Round Quenched in OIL at 1525 °F. Drawn as Shown Below.

This chart shows actual analysis reported by the mill on the heat indicated by symbol letters. It also shows physical properties developed by heat treatment test on 1" round sample of this heat. The data shown will vary from one part of the heat to another due to permissible segregation and normal variation of analysis determinations.

This information is given for the guidance of our customers in determining the best heat treatment for this steel, but it will not be accepted as a basis for rejection of material nor establishment of claims. Do not neglect to consider effect of mass on the results developed by heat treatment.

Ryerson Certified Alloy Steel Data Sheet for the higher alloys that are hardened by quenching. One of these data sheets, covering the particular steel shipped, is sent to the customer. It gives him information upon which he can predicate heat treatment results without making tests, and so on.

to transfer the accumulated information about the steel to the customer.

In order to condense the information regarding these special heats, Ryerson revised two types of charts, one for carburizing (case hardening) steels, and the other for steels of higher hardening characteristics which are heat treated by quenching. These charts, in the case of the carburizing steels, give the heat analysis identification letter, McQuaid Ehn grain size, cleanliness rating, and also the results of a carburizing test of a standard sample. This

All Ryerson Certified Alloy Bars are clearly identified by heat symbol letters stamped on the end of the bar. The same symbols are repeated on the Ryerson Certified Alloy Steel Data Sheets which are sent to the customer.

shows the hardness of the case, the effective depth of the case and the physical characteristics of the core.

In the case of the quenching steel, the analysis, identification letters, McQuaid Ehn grain size, and cleanliness rating is shown, together with curves representing the tensile strength, yield point, elongation, reduction of area, Brinell hardness, and so on, as developed by test specimens quenched at a suitable temperature for the analysis and drawn to various temperatures. Thus the heat treater has complete information on the particular steel with which he is dealing as well as a record for his file as to the composition of the steel used in every job which has gone through his shop.

In summarizing the plan, the following

outstanding points are found:

No. 1, Warehouse stocks of alloy steels are now available which have been selected to meet specifications much closer than the standard S. A. E. ranges and which are accurately controlled in regard to grain size and other hardening characteristics.

No. 2. All bars except very small diameters are identified by letter symbols stamped into the ends of the bars. Small bars are tagged.

No. 3. All bars have been metallurgically tested and the results of these tests, covering both chemical analysis and heat treatment response, have been tabulated on similarly identified data sheets.

No. 4. When a shipment is made to a user, a data sheet for the bars shipped is placed in his hands in sufficient time so that it can be transferred to the heat treating department before that department is called upon to subject the steel to heat treatment.

No. 5. The plan simplifies the heat treating department's problem because they know exactly what material they have to work with and have been informed ahead of time as to how it will respond to heat treatment. The purchasing department's problem is made easier because satisfactory steels can be duplicated. The production department is helped because there are no delays due to trouble in heat treating.

The Ryerson Company has prepared a book describing the plan and its advantages in detail and a copy is available to steel users upon request.

Logan "Sure Flow" Centrifugal Pump

A line of centrifugal pumps designed for pumping coolant, water, oil, or other fluids, has been developed by Logansport Machine, Inc., Logansport, Ind. The

pump is made in nine models, to deliver from 4 to 150 gal. per minute. The pump operates in a vertical position, and since side-wall mounting frequently proves most satisfactory from the point of convenience and accessibility, the vertical mounting base bracket is optional on all models.

The Logan pump is self-priming under all normal applications; thus it is not necessary to submerge any part of the pump in the liquid. No foot or check valves are required in the intake line except in extreme installations approaching maximum lift where the capacity of the line may exceed that of the pump reservoir. Therefore the pump may be located at any convenient point near the

Logan Sure Flow Centrifugal Pump

operation, with the tank also located for greatest convenience and space saving.

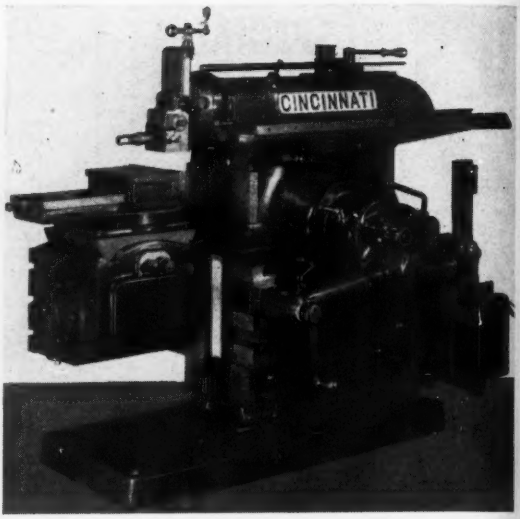
The Logan pump will handle practically any type liquid. There are no metal-to-metal contacts and no close clearances are exposed. Bearing surfaces are protected by rotary seals, therefore the pump will safely pump liquids charged with abrasives, filings, most corrosive impurities, and even solids within reasonable limits. The pumped liquid is delivered at the point of application im-

mediately; i.e., at the instant of starting the operation.

The Logan pump is available with direct motor drive, belt drive, or adapter for direct power take-off. The adapter model generally lends itself readily to special application, either as replacement or original equipment. Flat or V-type pulleys are optional on all belt driven models. The Logan engineering department will cooperate in the design of special bases or special adaptations of the pump.

Cincinnati High Speed Shaper

The Cincinnati Shaper Company, Cincinnati, Ohio, has added a high speed Shaper to their line of Rapid Traverse, Universal, and Utility Shapers. This Shaper, illustrated herewith, differs little in appearance from



Cincinnati High Speed Shaper

the Universal or Rapid Traverse 16-in. Shaper. The construction, however, is different to accommodate the high speed provided.

The rocker arm and link are of aluminum alloy to reduce the weight of reciprocating parts and to insure smooth reversals at 200 strokes a minute. The ways for the sliding block are cast iron and provide excellent bearing conditions in combination with the steel gib.

The head of the shaper is equipped with a clapper retainer that can be made inoperative at will. This device restricts the upward swing of the clapper and insures the proper operation of this member. The head of the high speed shape can also be equipped with a tool lift which protects the cutting edges of tool This is essential with cemented tungste carbide tools.

The ram of the shaper is of Meehanit which permits a reduction of weight an an increase in strength and accurac This material, moreover, operating i the cast iron bearing of the colum provides excellent bearing conditions.

The advantage of this tool, of cours is the 16-in. heavy duty capacity com bined with high speed operation. Th 200 strokes a minute meet all demand of practicable high production require ments. The 4500 pounds weight, the fu 16-in. stroke, the generous work spac table travel, light capacity, and rigid ar and column insure greater usefulnes accuracy, and long life.

Complete Range of Self-Aligning Bearings Now Made by Fafnir

Three distinct types of self-aligning ball bearings are now offered by Th Fafnir Bearing Company, New Britain Conn., in a full range of sizes. Whe ever this style of bearing is necessar Fafnir offers a self-aligning construction to meet every normal requirement.

In the "B" type, Fafnir bearing th conventional outer ring is made wi its outside surface spherical instead cylindrical. A concave inner surface the housing, which corresponds to th convex outer surface of the ring, pe mits the bearing to swivel into tr alignment with the shaft.

The Fafnir "S" type permits the co ventional cylindrical inner surface of th housing to be retained, by providing extra self-aligning ring with a conca inner surface. This extra ring surroun the spherically ground outer bearing ri proper to form the alignment sock Advantages claimed are: Requires o simple, straight-bore housing; ea

mounting similar to ordinary radial bearings; and ring-to-ring contact with no movement against the housing.

The "L" type gives self-alignment entirely from within the outer bearing ring, permitting housing to be both straight-bored and of minimum diameter. A double row of balls is used in all Fafnir "L" type bearings, including single row widths. The two rows of balls, tracked by two races on the inner ring, are left free to locate themselves in one spherical race on the outer ring. Here, the balls themselves roll the inner ring and shaft into alignment.

These Fafnir Self-Aligning Bearings are available in Single Row and Double Row type, and also in the well-known Wide Inner Ring type.

Lincoln Industrial Lubricating Equipment. The result of some 15 years of experience in the development and manufacture of lubricating equipment for industrial applications is presented in this 28-page book, now being issued by Lincoln Engineering Company, 5705 Natural Bridge Ave., St. Louis, Mo. The line includes Maintenance Applications, involving the periodic lubrication of bearings and moving parts of machines and equipment in the factory, mill, shop, or roundhouse, and Production Applications, involving the initial lubrication of manufactured products in the course of production or assembly.

Many of the Lincoln units described in this catalog are equally useful for either type of service. The selection of the correct equipment is frequently possible from a careful reading of the catalog description, but there will remain many prolbems where the company's engineers can be of assistance in arriving at the most practical solution.

The book presents the Airline Lubriguns, for which air from the shop air-

line is applied to provide pressure; industrial lubricators which handle either light or heavy, viscous fluids; electric Lubriguns, provided with motor-driven plunger pumps for dispensing semi-solid lubricants, Air-Operated Fluid Lubricant Dispensers; and the accompanying equipment. Copy free.

Cranes and Transfer Bridges. A number of different types and designs of cranes and transfer bridges as manufactured by The Cleveland Tramrail Division of The Cleveland Crane & Engineering Company, Wickliffe, Ohio, are illustrated and described in a folder which is now being distributed by this firm. Copy free upon request.

Morse Silent Chain Engineering Data Book. The Morse Chain Company, Ithaca, N. Y., announces the Morse 1937 Silent Chain Engineering Data Book. In this 20-page booklet has been gathered detailed information that plant engineers and production men most frequently require in plan and specifications for silent chain drives.

A partial list of the new book's contents include horsepower tables, explanation of the different types of Morse Silent Chains and their applications, layouts of typical shoes and idlers, sprocket data, directions for cutting sprockets, how to calculate chain length, special sprockets and their uses, chain cases and methods of oiling. It is profusely illustrated with photographs, detailed drawings, and special graphs.

This booklet is offered free upon request to everyone who wishes to make use of the data it contains.

Jarvis Catalog M. S. T. of Flexible Shaft Driven Power Tools. The complete line of Biax and Jarvis Flexible Shaft Machines, together with accessory equipment and tools, are presented in a 28-page catalog, 8½x11 in. in size, now being distributed by The Charles L. Jarvis Company, Middletown, Conn. Included in the equipment are the Multi-Biax bench type, floor type, overhead trolley type, and overhead saddle type flexible shaft machines, Supra-Biax roller floor and overhead types, and the Jarvis Vario-Flex machines, single speed machines, Jarvis screw and nut setters, and Jarvis screw drivers. Jarvis self-contained shafts for your own motor are also included.

Among the accessories presented are

Jarvis right angle gears and hand-pieces, accessories and tools, and sanding drums, buffs, steel wire brushes, grinding wheels, and the complete line of Jarvis-Blax hand cut, mill cut and ground rotary files, routers and rasps.

All items are illustrated and described, with tables of specifications. Copy free upon request.

Cullman Machine Tool Drives. This eight-page folder shows how a motor drive unit operating with belt drive smoothness can be applied to any type of belt driven machine to provide it with an individual motor drive. The bulletin explains the various features of the unit such as making the machine entirely self-contained, elimination of overhead countershafts and belting, silent and efficient operation of the machine, flexibility of machine location and alignment, and so on. The bulletin is illustrated with photographs of machine shops and departments where these units are in operation, and includes a list of important manufacturers who are using the Cullman Machine Tool Drive. Copy free by addressing Cullman Wheel Co., 1336 Altgeld St., Chicago,, Illinois.

Dart Union Catalog. Complete data on Dart pipe unions and fittings is given in the new catalog just published by the E. M. Dart Manufacturing Company, Providence, R. I. Full information on types, sizes, and prices is included with color illustrations showing the distinctive full-bearing, true ball-joint construction. In addition to tables giving dimensions, the catalog describes the precision operations, materials, and methods of inspection used in the manufacture of Dart Unions.

It also illustrates the processes of precision machining and oscillating-grinding the special two bronze seats—cutting accurate threads on tapping machines of Dart's own design — and testing the finished unions with air under water.

Copies can be obtained free by writing to Dart distributors or direct to the manufacturer.